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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 20
OCTOBER 15, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 20
OCTOBER 15, 1979

W79-09081 -- W79-09330

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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09 MANPOWER, GRANTS, AND FACILITIES
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS,
Texas A and M Univ., College Station. Remote Sensing Center.
For primary bibliographic entry see Field 7B.
W79-09134

NON-POINT SOURCE STUDIES ON CHESAPEAKE BAY, 4: WEEKLY SURFACE HYDROLOGY OF SEVEN SUB-BASINS WITHIN THE RHODE RIVER WATERSHED, CALENDAR YEARS 1974-1975-1976, CRC PUBLICATION NO. 57,
Smithsonian Institution, Edgewater, MD. Chesapeake Bay Center for Environmental Studies.
G. R. Chirlin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-276 863, Price codes: A04 in paper copy, A01 in microfiche. CRC Publication No. 57, NSF/RA-770383, May 1977. 62 p, 14 fig, 5 ref, 4 tab, 1 append. NSF R804536-01.

Descriptors: *Maryland, *Chesapeake Bay, *Watersheds(Basins), Hydrology, Rivers, Water quality, Stations, Sampling, Flow, Networks, Precipitation(Atmospheric), Runoff, Land use, Surface waters, *Sub-basins, *Rhode River(MD), Non-point sources.

In Part IV of this project, weekly total precipitation, runoff, and their difference net input were tabulated for 7 tributary sub-basins of Rhode River, Maryland, watershed. The data were discussed briefly. The limitations of a three raingage network to sample 982 ha over 7 sub-basins were examined, and coefficients of variation up to 0.57 were found for weekly precipitation totals above 2.5 cm. (Froehlich-ISWS)
W79-09136

GEOHYDROLOGY OF COMAL, SAN MARCOS, AND HUECO SPRINGS.
Texas Department of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-09139

EFFICIENCY OF THE REAL-TIME HYDROLOGICAL FORECASTING SYSTEMS IN POLAND AFTER SYSTEM OPERATION IN 1975-77,
Institute of Meteorology and Water Management, Warsaw (Poland).
E. Bobinski, T. Piwecki, and J. Zelazinski.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria) 28p, 5 fig, 2 tab, 10 ref.

Descriptors: *Hydrologic systems, *Forecasting, *Poland, *Rivers, Efficiencies, Hydrographs, Mathematical models, Performance, Real-time, Water management(Applied), Meteorology, River systems, Systems analysis, Data transmission, Data collection, Rainfall, Runoff, Channel routing.

The development and implementation of a real-time hydrologic forecasting system for water management is now the key task for Poland's Hydrometeorological Service. These systems are to be implemented for the operation of some dozen major reservoirs and for the management of navigable reaches of two large Polish rivers: the Vistula and the Odra. Operated in the summer are two mountainous rivers: Considered are the Sola and the Dunajeo/rainfall-runoff model, and the river stage/depth hydrograph forecast system for the lower Vistula/channel routing model. Discussed are system implementation, operation and efficiency. Emphasis herein is on the experience gained with the system implementation and operation, especially in terms or organization of the data collection, transmission and processing, hardware and staff employed, the forecast efficiency, and several new problems arising. (See also W79-09285) (Bell-Graf--Cornell)
W79-09289

OPERATIONAL HYDROLOGICAL FORECASTING BY CONCEPTUAL MODELS IN SWEDEN,
Swedish Meteorological and Hydrological Inst., Norrkoping.
S. Bergstrom.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 19 p, 8 fig, 1 tab, 3 ref.

Descriptors: *Sweden, *Runoff, *Forecasting, *Model studies, Watersheds(Basins), Hydrologic data, Data collection, Data processing, Flooding, Risks, Spring, Costs, Benefits, Snowmelt, Precipitation, Simulation analysis, Rivers, Systems analysis.

Since 1972, the Swedish Meteorological and Hydrological Institute (SMHI) has been engaged in the development of a conceptual runoff model suitable for operational forecasting and other applications under Scandinavian conditions. The model now operates in ten catchments in Sweden, and forecasts are issued regularly every spring and on some occasions in autumn and winter. Discussed herein are: model structure and calibration; applications for operational forecasting; data collection and processing; updating the model; forecasting procedures; short-range forecasting; forecasts at remaining springflood volumes; estimation of risks for high floods; and costs and benefits. (See also W79-09285) (Bell-Graf--Cornell)
W79-09290

DIFFUSION EQUATION AS A IMPULSIVE RESPONSE FOR THE FLOOD EVENTS MODELLING,
Hydrometeorologicky Ustav, Prague (Czechoslovakia).
J. Buchtele.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 25 p, 5 fig, 1 tab, 10 equ, 12 ref, 2 append.

Descriptors: *Flood forecasting, *Rainfall-runoff relationships, *Simulation analysis, *Model studies, *Diffusion equation, Flood volume, Flood events, Water storage, Equations, Transformation procedure, Systems analysis.

The procedure herein, expressing the variability of impulsive response in dependence on three characteristics of rainfall, was examined as a compromise between the models with distributed parameters and simplifying lumped models. Used characteristics are: rainfall intensity, distance of rainfall center from the watergage station and the index of areal nonuniformity. These characteristics were taken as the parameters for the diffusion equation, which is used for analytical expression of impulsive response. The experiments were made with the set of 30 floods (25 of which were from the same catchment). The procedures for estimation of the flood volume and discharges in rainless periods are also briefly described. (See also W79-09285) (Bell-Graf--Cornell)
W79-09291

THE USE OF HYDROLOGICAL MODELS FOR RUNOFF FORECASTS FOR SHORT-TIME OPTIMIZATION OF THE NORWEGIAN WATER POWER SYSTEM,
B. Wingard.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 19 p, 7 fig, 1 tab, 11 ref.

Descriptors: *Hydropower, *Runoff, *Forecasting, *Hydrologic models, *Optimization, *Simulation analysis, *Norway, ARIMA model, Weather forecasts, Production plans, Model testing, Watersheds(Basins), Spring, Systems analysis.

A project was organized in 1977 to compare 4 hydrological models for runoff forecasting for short-time water power optimization. Two conceptual models were found to give reliable results for forecasting of total spring volume. An ARIMA model was recommended for computations of spring runoff and volume due to its difficult-to-model varying climatic conditions. Actual research fields to improve models and data were better snow and soil routines, and more relevant observations of snow reservoir, soil reservoir, precipitation and temperature. Input to the forecasting models are meteorological quantitative forecasts, a field that should be given much attention. Suggestions of how to implement hydrological forecasts in the daily work of the hydropower companies are presented. The costs of model calibration, updating and forecasting are shown together with the data needs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09292

USE OF CATCHMENT MODELS FOR FLOOD FORECASTING IN CENTRAL AMERICA,
World Meteorological Organization, Geneva (Switzerland).
A. J. Askew.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 8 p, 4 ref.

Descriptors: *Flood forecasting, *Mathematical models, *Central America, *Watersheds(Basins), Projects, Data collections, Personnel, Computers, Developing countries, Systems analysis, Simulation analysis, Hydrology.

Between 1976 and 1978, a WMO/UNEP project was undertaken, one of the aims of which was to test the feasibility of using mathematical catchment models in flood forecasting systems in Central America. The Sacramento and CLS models were installed in the region and fitted to local catchments. The experience gained during the execution of the project has permitted a number of useful conclusions to be drawn concerning problems that may be encountered in applying catchment models in developing countries. Both the CLS and Sacramento models are now securely installed at centers in the region and are available for use by local hydrological services. (See also W79-09285) (Bell-Graf--Cornell)
W79-09294

HYSIM - A PHYSICALLY REALISTIC, GENERAL PURPOSE, HYDROLOGIC MODEL,
Severn-Trent Water Authority, Birmingham (England).
R. E. Manley.
In: Internationale Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Australia). 21 p, 1 fig, 1 tab, 8 ref.

Descriptors: *Hydrology, *Mathematical models, *Simulation analysis, Computer programs, Watersheds(Basins), Flow, Hydrologic data, Hydraulics, Costs, Severn River(England), Systems analysis.

During the past 20 years, many hydrological simulation models have been developed, but only a

small proportion have been widely used, being employed for relatively limited research exercises. This paper describes HYSIM (Hydrologic Simulation Model). It has been used for three years in the Severn-Trent Water Authority, the second largest in England and supplier of the full range of water services to 8 million consumers. It has also recently been made available to additional organizations including other water authorities, research institutions, and consultants. The paper begins by briefly describing the model itself and then its development. The major part of the article examines the application of the model and the role it has played in the functioning of the water authority. (See also W79-09285) (Bell-Graf--Cornell)
W79-09296

LINEAR MATHEMATIC MODEL SIMULATING SURFACE OUTFALL IN A MOUNTAIN CATCHMENT AREA,
Institute of Meteorology and Water Management, Warsaw (Poland).
J. Ostrowski.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 22 p, 3 fig, 20 equ, 12 ref.

Descriptors: *Rainfall-runoff relationships, *Simulation analysis, *Watersheds(Basins), *Surface runoff, Measurement data, Data requirements, Optimization, Linear model, Equations, Computers, Systems analysis.

Presented is a linear mathematical model of the surface runoff due to rainfalls. The model refers to basic hydrological processes influencing the surface runoff. The model's structure is presented along with the measurement data requirements and with optimization, identification, and verification techniques. The attached graphs illustrate a high degree of correlation between results of model simulation and field measurements. Finally, practical aspects of the model's application are discussed in relation to the computing technique. (See also W79-09285) (Bell-Graf--Cornell)
W79-09297

AUTOMATIC CALIBRATION OF THE TANK MODEL,
M. Sugawara.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 22 p, 11 fig.

Descriptors: *Tank model, *Simulation analysis, *Hydrology, *Computers, *Calibration technique, Effects, Discharge(Water), Equations, Hydrographs, Rivers, Computer programs, Feedback, Rainstorms, Systems analysis.

In spite of its simplicity, the tank model presented herein can yield good results to rivers of many regions; owing to its simple structure, there is no difficult problem in terms of computer technique, and its program is easy to understand for users. The only difficult problem is the calibration of the model, partly because of its nonlinear structure and partly because its structure is very difficult for input-output analysis. Accordingly, the only way is the method of trials and errors. To make the automatic calibration program is the most important point of the computer technique for the tank model. Considered herein are: (1) the necessity of the automatic calibration program; (2) the division into subperiods; (3) model use; (4) feedback formulae; (4) effect of random deviation of the time lag of peak discharge; (5) some improvement for the quick convergence; (6) modified mean square error; (7) divergence; and (8) the necessity for the feedback system which is strong against noises. (See also W79-09285) (Bell-Graf--Cornell)
W79-09299

2B. Precipitation

STOCHASTIC MODELS FOR DERIVING INSTANTANEOUS PRECIPITATION RATE DISTRIBUTIONS,
Air Weather Service, Scott AFB, IL.
A. R. Davis, and D. J. McMorrow.
Report AWS-TR-263, July 1976. 25 p, 42 tab, 16 ref.

Descriptors: *Precipitation(Atmospheric), *Rainfall, *Model studies, Mathematical models, Stochastic processes, Computer models, Data processing, Analytical techniques, Climatic data, Climatology, Meteorology, *Instantaneous precipitation rates, Precipitation rates, Rainfall rates.

One-minute and 4-minute precipitation rate records were used to develop stochastic model relations between clock-hour and 1-minute (or 4-minute) precipitation rate distributions. These models can be used to estimate annual and seasonal distributions of instantaneous precipitation rates for locations where distributions of clock-hour rates are known. The models were derived for 13 locations. (Sims-ISWS)
W79-09151

2C. Snow, Ice, and Frost

GLACIOLOGICAL DATA, THIS ISSUE: GLACIOLOGICAL FIELD STATIONS, PART I,
World Data Center A for Glaciology, Boulder, CO.
R. Vivian.
Report GD-4, February 1979. 110 p, 1 tab, 143 ref.

Descriptors: *Glaciology, *Data collections, *Geophysics, Foreign countries, Glaciers, Snow, Ice, Publications, Stations, Foreign research, Research and development, Glaciological field stations.

In October 1977, a questionnaire was circulated to all glaciologists belonging to the International Glaciological Society and to various national and international organizations concerned with snow and ice. The objective of the questionnaire was to assess the worldwide mechanisms used for glaciological research, with particular reference to glaciological field stations. The following information was collected: the location of centers of glaciological studies, regional distribution of centers, center activities and staff and materials available at each center, what particular problems are studied at each center, when the studies began, how the data are collected, in what form the data exist, and what publications describe and tabulate the research. The report was published in 2 parts. (See also W79-09133) (Froehlich-ISWS)
W79-09132

GLACIOLOGICAL DATA, THIS ISSUE: GLACIOLOGICAL FIELD STATIONS, PART 2,
World Data Center A for Glaciology, Boulder, CO.
R. Vivian.
Report GD-4, February 1979. 130 p, 1 map, 130 ref.

Descriptors: *Glaciology, *Data collections, *Geophysics, Foreign countries, Glaciers, Snow, Ice, Publications, Stations, Foreign research, Research and development, Glaciological field stations.

In October 1977, a questionnaire was circulated to all glaciologists belonging to the International Glaciological Society and to various national and international organizations concerned with snow and ice. The objective of the questionnaire was to assess the worldwide mechanisms used for glaciological research, with particular reference to glaciological field stations. The following information was collected: the location of centers of glaciological studies, regional distribution of centers, center activities and staff and materials available at each center, what particular problems are studied at each center, when the studies began, how the data are collected, in what form the data exist, and what publications describe and tabulate the research. The report was published in 2 parts. (See also W79-09132) (Froehlich-ISWS)
W79-09133

WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE), NEW ACCESSIONS LIST NO. 1.
Colorado Univ., Nederland. Inst. of Arctic and Alpine Research.
December 1978. 47 p.

Descriptors: *Glaciology, *Snow, *Ice, *Bibliographies, Computers, Snow cover, Glaciers, Avalanches, Polar regions, Sea ice, Permafrost, Abstracts, Data collections, Publications, Paleoglaciology, Polar ice.

The first quarterly list of documents acquired by the Data Center during the period June-August 1978 has been published. The list was generated from a new computerized bibliographic data system. Books, technical reports, conference proceedings and reprints were included; most journal articles have not yet been indexed. The subject headings are those used by the Cold Regions Research and Engineering Laboratory in their Bibliography on Cold Regions Sciences and Technology. Bibliographic items were repeated in their entirety under each appropriate subject heading. (Froehlich-ISWS)
W79-09135

SOME PHYSICAL PROPERTIES OF SEA ICE. I,
McGill Univ., Montreal (Quebec). Ice Research Project.
E. R. Pounder, and E. M. Little.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 465, Price codes: A03 in paper copy, A01 in microfiche. Report of Navy Electronics Laboratory, San Diego, California. 33 p. Reprinted from Canadian Journal of Physics, Vol. 37, p 443-473, April 1959. 35 fig, 5 tab, 16 ref.

Descriptors: *Sea ice, *Physical properties, *Ice, *Arctic, *Canada, On-site investigations, Laboratory tests, Specific gravity, Salinity, Electrical resistance, Permeability, Strength, Shear strength, Tensile strength, Physics, *New Brunswick, *Shippegan(New Brunswick).

This preliminary study was based mostly on work done at a shore station in Shippegan, New Brunswick, during the winter of 1956-57, with some data from an ice-breaker expedition in the summer of 1956. The Shippegan site had unrafted ice, tides of 5 feet or less, and negligible freshwater runoff. The thickness of the ice was about proportional to the square root of the freezing exposure. Tritium dating of sea ice is an unsatisfactory method because of variable tritium concentration in Arctic waters. The jaggedness of ice crystals was suggested as a measure combining effects of age and thermal regime. Measurements of specific gravity, salinity, electrical resistivity, and permeability profiles all showed progressive changes in annual sea ice throughout the winter. The tensile strength of sea ice at -20 C was around 200 to 500 p.s.i. at various angles to the grain. For freshwater ice, with stress parallel to the grain, it was in the range 500 to 1000 p.s.i. Shear strengths, with the shear plane parallel to the grain, were 80 to 160 p.s.i. for sea ice at -20 C and 160 to 280 p.s.i. for pond ice, also at -20 C. (Sims-ISWS)
W79-09149

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitets vensen, Oslo.
J. E. Skorve.
Final Report, May 25, 1977. 26 p, 22 fig, 2 tab, 6 ref.

Descriptors: *Snow packs, *Snow surveys, *Remote sensing, *Runoff, *Snowmelt, River basins, Glaciers, Data collections, Satellites(Artificial), *LANDSAT imagery, *Nor-

wegian basins, *Norway, Snow line, Cumulative runoff.

Four drainage basins, less than 900 square kilometers in mountainous southern Norway, were selected for a study in snow mapping by the use of LANDSAT imagery. To get a better understanding of the snow situation, ground-based information was used. This ground-based information consisted of special snow accumulation maps issued by the Norwegian Meteorological Institute on a regular basis each winter and snow data from some weather stations. The runoff data were obtained from discharge stations near or at the base of the four basins. The observations covered the period from May 1975 to August 1976. The study showed that LANDSAT images are well suited for snow mapping in Norwegian mountainous areas. Data on variations in snow cover and runoff accumulated over several years will prove to be valuable tools in water management. (Singh-ISWS)
W79-09152

CRYOCONITE HOLES ON SERMIKAVSAK, WEST GREENLAND,
Saint Andrews Univ. (Scotland). School of Physical Sciences.
P. W. F. Gribbon.
Journal of Glaciology, Vol. 22, No. 86, p 177-181, 1979. 1 fig, 18 ref.

Descriptors: *Ice, *Glaciers, *Weathering, On-site investigations, Cold regions, Arctic, Melting, Solar radiation, Heat flow, Heat transfer, Dusts, Albedo, Glaciology, *Greenland, *Cryoconite holes.

The depths and diameters of 158 cryoconite holes were measured at 10 positions in the ablation zone of Sermikavsak, West Greenland. It was found that the depths increased on going up the glacier in agreement with other measurements made earlier on polar glaciers. There was no significant correlation of depth with diameter. The relative importance of the combined short- and long-wavelength radiation balances and the transfer of heat by convectional mixing in water-filled holes was discussed. The variations in depth were attributed to changes in the albedo and the bulk extinction coefficient of the surface ice layers on the glacier. (Sims-ISWS)
W79-09153

GRAVITATIONAL STRESSES IN FLOATING ICE SHEETS,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. J. Evans, and R. R. Parmerter.
Journal of Glaciology, Vol. 22, No. 86, p 182-185, 1979. 4 fig, 3 ref. NSF OPP71-04031.

Descriptors: *Ice, *Sea ice, *Stress, Stress analysis, Model studies, Mathematical models, Analytical techniques, Numerical analysis, Loads(Forces), Hydrostatic pressure, Gravity, Cracks, Physical properties, Gravitational stress.

This note was addressed to the determination of the in-plane components of stress in floating ice sheets due to gravity and the hydrostatic pressure in the water. The distribution and magnitude of these stresses are of interest with regard to crack propagation in sea ice. Two cases were considered. In the first, the ice sheet is formed on land by accretion at the top surface and then introduced into the water, such as happens in the Antarctic. In the second, the ice is formed in the water by accretion on the bottom, which is the usual situation in the Arctic pack ice. (Sims-ISWS)
W79-09154

ACOUSTIC EMISSION AS AN INDICATION OF STABILITY DECREASE IN FRACTURE ZONES OF AVALANCHES,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
H. Gubler.
Journal of Glaciology, Vol. 22, No. 86, p 186-188, 1979. 2 fig, 3 ref.

Descriptors: *Snow, *Stability, *Avalanches, *Acoustics, Snowfall, Winds, Solar radiation, Snow cover, Mountains, Instrumentation, On-site investigations, On-site data collections.

Measurements of the event rate of natural, small-amplitude displacement accelerations in potential fracture zones of avalanches proved to be good indications for decrease of stability. (Sims-ISWS)
W79-09155

THE INTERPRETATION OF A TERTIARY TILLITE AT MOUNT FEATHER, SOUTHERN VICTORIA LAND, ANTARCTICA,
Macquarie Univ., North Ryde (Australia). School of Biological Sciences.
H. Brady, and B. McKelvey.
Journal of Glaciology, Vol. 22, No. 86, p 189-193, 1979. 3 fig, 10 ref. NSF DPP74-22894.

Descriptors: *Glaciers, *Glacial drift, *Petrography, *Antarctica, Glaciation, Rocks, Till, Sediments, Drainage, Glaciology, *Mount Feather(Antarctica).

A Tertiary tillite occurs at an altitude of 2,750 m on Mount Feather in southern Victoria Land. The tillite mantles a remnant of the floor of a southeast-trending glacial valley that pre-dates the cutting of the existing glacial drainage system in southern Victoria Land. Petrographic evidence suggests that ice which deposited the tillite drained a relatively distant source area. (Sims-ISWS)
W79-09156

2D. Evaporation and Transpiration

MATHEMATICAL DESCRIPTION OF ACTUAL EVAPOTRANSPIRATION - WITH PARTICULAR REGARD TO GRASS COVER,
Institute of Meteorology and Water Management, Warsaw (Poland).
J. Jaworski.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 17 p, 2 fig, 9 equ, 17 ref.

Descriptors: *Evapotranspiration, *Grass cover, *Simulation analysis, Meteorological data, Physiologic crop characteristics, Constant soil parameters, Precipitation, Diffusive crop resistance, Water balance, Equations, Reservoirs, Aeration zone, Computer programs, Model benefits, Mathematical models, Daily, Hourly, Systems analysis.

The proposed, physically-based model allows a correct quantitative description of actual evapotranspiration for short time intervals on the basis of meteorological data, physiologic crop characteristics and constant soil parameters. The model transforms potential evapotranspiration and real precipitation into actual evapotranspiration by means of diffusive crop resistance, the water balance equation and two fictitious reservoirs, representing the upper and lower layer of the aeration zone. The developed model is time invariant and operates with a total of seventeen parameters, from which only two are obtained in optimization process. Most parameters and functions contained in the model are physically based. The estimation of actual evapotranspiration amounts for daily or hourly time intervals enables a computer program in FORTRAN, elaborated for computers of the Odra 1305 type. The developed and experimentally tested model can be used for estimating actual evapotranspiration if an extension of a short evapotranspiration record is needed; for evaluation of changes in crop or climate on evapotranspiration amounts; for estimating and forecasting soil moisture in the aeration zone; for estimating irrigation requirements; and as a subsystem in a river catchment model or in a water resources system. (See also W79-09285) (Bell-Graf--Cornell)
W79-09298

2E. Streamflow and Runoff

POTENTIAL NONSTRUCTURAL OR LOW COST WATERWAYS SYSTEM IMPROVEMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6F.
W79-09131

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME I--EXECUTIVE SUMMARY.
IBM Corp., NY.
For primary bibliographic entry see Field 7B.
W79-09143

HYDROLOGY OF THE WEST FORK DRAINAGE OF THE GALLATIN RIVER, SOUTHWESTERN MONTANA, PRIOR TO COMMERCIAL RECREATIONAL DEVELOPMENT,
Montana State Univ., Bozeman. Center for Interdisciplinary Studies.
W. A. V. Voast.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 152, Price codes: A02 in paper copy, A01 in microfiche. Research Monograph No. 9, February 1972. 19 p, 10 fig, 4 tab, 16 ref. NSF GI-38.

Descriptors: *Regional analysis, *Land management, *Aquifer characteristics, *Hydrologic systems, *Montana, Recreation facilities, Hydrology, Groundwater, Regime, Land use, *Gallatin River, *West Fork drainage.

The investigation of the hydrology of the West Fork drainage of the West Gallatin River was conducted to determine natural hydrologic conditions and to describe the natural system so that any cause-and-effect relationships of development and incipient hydrologic changes can be better understood. About 40% of the estimated average annual runoff and about 50% of the minimum daily discharge leaving the West fork originate in subdrainages where commercial recreational development is planned. The surficial aquifer and the streams are interdependent in the hydrologic system. In some places, the aquifer discharges to the stream; but in other places, the stream discharges to the aquifer. Because of their interconnection, neither streams nor the surficial aquifer can be considered as independent sources of water. Most of the water in the unconsolidated aquifer is suitable for domestic, stock, and irrigation use. (Singh-ISWS)
W79-09148

TRANSFER FUNCTION-NOISE MODEL APPLIED TO FLOW FORECASTING,
Laboratorio di Ricerca per la Protezione Idrogeologica nel Bacino Padano, Turin (Italy).
V. Anselmo, and L. Ubertini.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, 24-26 October, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 8 p, 2 fig, 10 equ, 4 ref.

Descriptors: *Streamflow forecasting, *Simulation analysis, *Transfer function-noise model, Watersheds(Basins), Reliability, Hydrologic data, Storms, Real time, Stochastic processes, Parametric hydrology, Estimating, Equations, Systems analysis.

The combined transfer function-noise model investigated by Box and Jenkins has been used to identify a model and estimate parameters for the simulation and forecasting of streamflow. The model reliability was tested with storm hourly data and recorded in three watersheds of different areas. The model proved to be satisfactory in short term (few hours) forecastings. As real time streamflow forecasting may be of practical importance, details are given about program dimensions, data requirements and job execution costs. (See also W79-09285) (Bell Graf-Cornell)

W79-09287

COMPUTER PROGRAMME ARRANGING OPTIMIZATION, SIMULATION AND COMPUTING OF FORECAST,
Institute of Meteorology and Water Management, Warsaw (Poland).
A. Baniukiewicz.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 11 p, 2 fig, 1 tab, 6 ref.

Descriptors: *Computer programs, *Optimization, *Simulation analysis, *Forecasting, Streamflow, Runoff, Mathematical models, Hydrology, Meteorology, Systems analysis.

Models for studying water runoff from basins may be used for computing the actual forecasts of water flow in rivers and for supplementing the observational sequences with the lacking flows resulting from the so-called simulation. Such calculations must be preceded by adjustment of the model to a given river basin, and this is most frequently accomplished through optimization of model parameters. (See also W79-09285) (Bell Graf-Cornell)
W79-09288

EFFICIENCY OF THE REAL-TIME HYDROLOGICAL FORECASTING SYSTEMS IN POLAND AFTER SYSTEM OPERATION IN 1975-77,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2A.
W79-09289

DIFFUSION EQUATION AS A IMPULSIVE RESPONSE FOR THE FLOOD EVENTS MODELLING,
Hydrometeorologicky Ustav, Prague (Czechoslovakia).
For primary bibliographic entry see Field 2A.
W79-09291

ROUTING OF FLOOD EVENTS OF SPECIFIED PROBABILITY IN RESERVOIR SYSTEMS IN THE PREALPINE REGION,
Bayerische fuer Landesamt Wasserwirtschaft, Munich (Germany, F.R.).
P. Handel, and R. P. Spiegel.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 12 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Flood routing, *Reservoirs, *Hydrographs, *Computer programs, *Simulation analysis, Discharge(Water), Dams, Reservoir operation, Flood event, Prealpine region(W. Germany), Storage cascade, Data requirements, Hydrology, Mathematical models, Systems analysis.

Flood protection problems arise in the design of hydraulic structures. Using flood routing procedures, known flood hydrographs can be routed along the river in order to obtain hydrographs at the selected location. If there is a reservoir or a cascade of reservoirs in the river, the deformation of the wave by reservoir operating strategies has to be considered. Larger and faster computers have challenged engineers to develop more precise and sophisticated models. But great amounts of data required and of computer storage and time needed can restrict general application of these models. Therefore, a suite of four independent programs has been developed with special emphasis on low computer requirements and smaller data needs. The programs are successively compiled and executed; results are filed as input for successive programs. For comparison, the calculations were implemented on the TR 440 and the CYBER 175. To make efficient use of existing subroutines, the respective programs were programmed in Algol 60 or Fortran IV. A reach of the Lech River was chosen for demonstration. By means of the analytic hydrograph function which implicitly includes the four flood parameters, the storage cascade can be simulated. (See also W79-09285) (Bell-Graf--Cornell)
W79-09312

2F. Groundwater

GEOHYDROLOGY OF COMAL, SAN MARCOS, AND HUECO SPRINGS.
Texas Department of Water Resources, Austin.
Report 234, June 1979. 92 p, 27 fig, 6 tab, 153 ref.

Descriptors: *Texas, *Springs, *Water resources, *Hydrogeology, Spring waters, Data collections, Water quality, Discharge(Water), Aquifers, Recharge, Natural recharge, Streams, Water temperature, Chemical analysis, Water levels, Geology, Withdrawal, Groundwater resources, Precipitation(Atmospheric), Dissolved solids, Hardness(Water), *Comal Spring(TX), *San Marcos Spring(TX), *Hueco Spring(TX), *Edwards aquifer(TX).

The purpose of this report was to document information now available on Comal, San Marcos, and Hueco Springs, and to define the geologic and hydrologic conditions under which the springs occur. In their upper reaches, the Guadalupe, San Antonio, and Nueces River basins are crossed and hydrologically connected by the Edwards (Balcones Fault Zone) aquifer, which is the principal source of water supplies for Uvalde, Sabinal, Hondo, San Antonio, New Braunfels, San Marcos, and other users in this area. The aquifer receives water principally by infiltration from the streams which cross it. The water in the aquifer moves generally from west to east, across the lines of surface drainage divides, and is discharged through wells and springs en route. Comal, San Marcos, and Hueco Springs are in the eastern part of the aquifer of the aquifer. This investigation included a compilation of historical records of the flow of Comal, San Marcos, and Hueco Springs, the quality and temperature of the water, measurements of tritium contents of the water, and an evaluation of the hydrologic meaning of these measurements. Existing knowledge of correlations of the spring flows with water levels in wells, pumpage, recharge, and streamflow was compiled, and representative data were presented and discussed. Recharge areas for the three groups of springs were described. The possibilities of contamination of the water issuing from the springs were discussed. Recommendations were made for additional research and observations in the future. (Humphreys-ISWS)
W79-09139

WATER-LEVEL DATA FROM OBSERVATION WELLS IN THE SOUTHERN HIGH PLAINS OF TEXAS,
Texas Water Development Board, Austin.
S. W. Gammon, and W. R. Muse.
Report 21, April 1966. 543 p, 48 ref.

Descriptors: *Water levels, *Fluctuations, *Observation wells, *Texas, Wells, Maps, Hydrographs, Precipitation(Atmospheric), Data collections, Data processing, Measurement, Groundwater, Aquifers, Drawdown, Hydrogeology.

Evaluation of water level records is an integral part of every groundwater investigation. Water level records of an aquifer reflect the amount of water in storage and changes in storage as well as direction and rate of water movement. Consequently, compilation of water level data from selected wells on a long-term basis is essential. Tabulated in this report were records of water levels from observation wells for 29 counties of the Southern High Plains. These listings provide the following information: well number, depth of well, elevation of land surface in feet above mean sea level, dates of measurement, measurements of water level in feet below land surface, and changes (decline or rise) in water level from the previous year's measurement. These tables are reproduced from direct printouts of electronic data processing equipment. Preceding the table for each county is a well-location map. A well symbol and the last 3 digits of the well number appear on the map at the location of each well listed in the county tabulation. Hydrographs, showing changes in water level, were presented for selected representative wells following the respective county tabulations. (Sims-ISWS)
W79-09141

GROUNDWATER FLOW TO A DEEP WELL NEAR A RECTILINEAR CHANNEL,
Institute for Land and Water Management Research, Wageningen (Netherlands).
L. F. Ernst.
Journal of Hydrology, Vol. 42, No. 1/2, p 129-146, June 1979. 14 fig, 2 tab, 24 ref.

Descriptors: *Groundwater movement, *Mathematical models, *Channels, *Wells, Pumping, Theoretical analysis, Equations, Flow, Water table, Homogeneity, Drains, Flow nets, Boundaries(Surfaces), Model studies, *Image wells, Partial penetration.

In this paper a theoretical analysis was given of the groundwater flow in a homogeneous aquifer to a deep well in the proximity of a rectilinear canal. The resulting formulas were applicable, for a large part, both to steady and non-steady states. (Visocky-ISWS)
W79-09159

STEP-DRAWDOWN PUMPING TESTS FOR THE DETERMINATION OF AQUIFER AND BOREHOLE CHARACTERISTICS,
Water Research Centre, Marlow (England). Resources Div.
N. R. Brereton.
Technical Report TR 103, January 1979. 29 p, 10 fig, 4 tab, 16 ref.

Descriptors: *Aquifer characteristics, *Drawdown, *Aquifer testing, *Analytical techniques, Groundwater, Mathematical models, Boreholes, Water yield, Water wells, Pumping, Theoretical analysis, Withdrawal, Transmissivity, Storage coefficient, On-site tests, Analysis, Step-drawdown tests.

This report discussed the theoretical and practical aspects of short duration (one day) step-drawdown pumping tests. Analysis of the tests results (1) indicated the maximum yield for a given drawdown that can be operated from a well after any given period of pumping; (2) helped define the hydraulic rating of the pumping installation; (3) measured the hydraulic efficiency of the well and identified possible causes of high operating costs; and (4) monitored the long-term behavior of the well and identified possible reasons for a decline in well yield. It was concluded that when carried out in conjunction with the conventional constant-rate test, a step-drawdown test will lead to a much greater understanding of the behavior of both the well and the aquifer. Neither method gives enough information to determine head loss through the screen or pack of the abstraction well. (Humphreys-ISWS)
W79-09163

2G. Water In Soils

ESTIMATION OF THE LONGITUDINAL DISPERSION AND SORPTION COEFFICIENTS IN SATURATED SOILS BY STRAIGHT-LINE METHODS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.).
For primary bibliographic entry see Field 5B.
W79-09158

INFILTRATION DYNAMICS UNDER VARIOUS RANGELAND TREATMENTS ON UNIFORM SANDY-LOAM SOILS IN SOUTHEASTERN UTAH,

Utah State Univ., Logan. Watershed Science Unit.
G. F. Gifford.
Journal of Hydrology, Vol. 42, No. 1/2, p 179-185, June 1979. 8 fig, 1 tab, 6 ref.

Descriptors: *Infiltration, *Range management, *Utah, *Soils, Seasonal, Pinyon pine trees, On-site investigations, Grazing, Juniper trees, Sampling, Freeze-thaw effects.

Studies were made, over a 3- to 8-yr period, of mean seasonal and yearly changes in infiltration rates under various rangeland management practices within the pinyon-juniper type. Results of the study indicated that mean upper limits in measured infiltration rates range from a surprising 1.37-3.47 times the mean minimal rates, each mean value representing from 6-20 replications for a given sampling date. Soil biology may be important in determining seasonal trends in infiltration rates, as well as over-wintering freeze-thaw activity. Suggestions were given for sampling infiltration rates. (Visocky-ISWS)
W79-09160

PHYSICAL MODEL OF THE HYDROLOGY OF SLOPING HETEROGENEOUS FIELDS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
D. Hillel, and G. M. Hornberger.
Soil Science Society of America Journal, Vol. 43, No. 3, p 434-439, May-June 1979. 6 fig, 1 tab, 18 ref.

Descriptors: *Soil water movement, *Field capacity, *Model studies, Physical properties, Hydrology, Surface runoff, Slopes, Water storage, Heterogeneity, Storage, Soils, Flow, *Soil water dynamics, *Field water cycle, Dynamic simulation, Physical model, Sloping heterogeneous fields, Watershed dynamics, Unified approach.

A model simulating water flow and storage in a two-dimensional section of a sloping field, in which surface runoff, infiltration, evaporation, unsaturated soil moisture movement, and groundwater flow were represented as a series of interacting one-dimensional processes, was adapted to cases of horizontally heterogeneous fields. The model was illustrated in a series of simulation trials with variously constituted hypothetical fields of loam and clay soils, subjected to a 108-mm rainstorm. Runoff was found to depend on the fraction of the slope occupied by clay and on the relative location of the clay (whether upslope or downslope with respect to the loam). Groundwater recharge was found to be greater in the loam, as was the rate of lateral drainage. The capability of the model was discussed. (Roberts-ISWS)
W79-09161

STATUS OF INORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 3C.
W79-09234

2H. Lakes

SECONDARY PRODUCTIVITY OF THE NORTH PINE DAM,
Queensland Inst. of Tech., Brisbane (Australia). Dept. of Biology.
C. R. King.
Australian Water Resources Council Technical Paper No. 39, 1979. 90 p, 19 fig, 18 tab, 123 ref, 1 append. Australian Government Publishing Service, Canberra.

Descriptors: *Zooplankton, *Benthos, *Reservoirs, Aquatic animals, Aquatic life, Plankton, Copepods, Australia, Dams, Crustaceans, Rotifers, Aquatic microorganisms, Invertebrates, Diptera.

The monitoring of the filling stages of the North Pine Dam and observations regarding the establishment and activity of colonizing zooplankton and macrozoobenthic communities are reported. Samples of zooplankton populations were collected monthly from three sites for almost three years. Three Eckman-Birge grab samples for macrozoobenthos were taken at each of ten sites over one year. Twelve species of zooplankton had established viable and dominant populations in the lake by the end of 1976, when the lake reached full supply level. The twelve species included seven rotifers, two copepods, and three clodocerans. The dominant macrozoobenthic group was chironomids, which accounted for 95% biomass and production. Most zooplankton species conformed to seasonal patterns but major physical changes to the lake system modified the patterns. Zooplankton usually formed less than 1% of the particulate organic carbon and less than 5% of the particulate organic nitrogen and particulate phosphorous in the water. Figures are given for average annual standing crops, and production of zooplankton and macrozoobenthos; tonnes of carbon, nitrogen, and phosphorus processed are also given. (Schaefer-IPA)
W79-09084

A NUMERICAL HINDCAST MODEL FOR WAVE SPECTRA ON WATER BODIES WITH IRREGULAR SHORELINE GEOMETRY; REPORT 2, MODEL VERIFICATION WITH OBSERVED WAVE DATA,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
D. T. Resio, and C. L. Vincent.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A064 992, Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Paper H-77-9, December 1978. 55 p, 4 tab, 9 ref.

Descriptors: *Waves(Water), *Great Lakes, *Mathematical models, *Wave spectra, *Hindcasting.

The procedures used to verify a numerical model for wave generation in water bodies of arbitrary shape are described. The verification results for Lakes Erie, Ontario, and Superior are presented. Parameters in the study include significant wave height and frequency at the spectral peak. Examples of hindcast and measured one-dimensional (frequency) spectra are given. The study indicates a capability of the model to hindcast significant wave height such as root-mean-square error of about 1.5 ft and to hindcast the period of peak frequency with a root-mean-square error of 1 sec. These errors include effects from both the wave model and the hindcast model used to estimate the windfield. (WES)
W79-09094

EVALUATION OF THE CHLOROPHYLL CONCENTRATION TO PREDICT THE TROPHIC STATE OF LAKES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
For primary bibliographic entry see Field 5B.
W79-09142

HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 7, FLOOD CONTROL BY RESERVOIRS,
Hydrologic Engineering Center, Davis, CA.
For primary bibliographic entry see Field 4A.
W79-09145

EAGLE LAKE POLLUTION CONTROL PROJECT: ASSESSMENT OF LAKE IMPROVEMENT,
Minnesota Univ., Morris. Div. of Science and Mathematics.
J. J. Latterell, R. S. Abbott, T. E. Straw, J. B. Van Alstine, and C. F. Myette.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 148, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Minneapolis. Bulletin 100, June 1979. 126 p. 25 fig, 38 tab, 47 ref. OWRT A-999-MINN (49), 14-34-0001-8025.

Descriptors: Community action, *Sewage disposal, Nutrients, Limnology, *Lake sediments, Water balance, Eutrophication, Eagle Lake(MN).

In this study of the response of Eagle Lake, Kandiyohi County, MN, to the removal of septic effluent, detailed studies of the biological, chemical, sedimentological, hydrological and physical conditions in the lake were conducted. Comparisons of the data collected in this fifth year study were made with bench mark data. An annual hydrologic budget for Eagle Lake was prepared for the 1978 water year. Results show that the amount of water that flowed through Eagle Lake in the 1978 water year was 6,719 acre-feet. Inflow to the lake comprised 45 percent surface water, 22 percent ground water, and 33 percent precipitation. Water out of the system comprised 72 percent surface water, less than 1 percent ground water, 25 percent evaporation, and slightly greater than 2 percent net change in lake storage. Several observations give evidence of an improvement in the quality of Eagle Lake waters after the installation of a peripheral sewage collection line. One such observation is the decrease in total nutrient loads of nitrogen and phosphorus at the spring turnover 1978. However, increases in the phytoplankton biomass and the shifts in the most abundant species with the blue-green algae assuming dominance do not indicate an improvement in water quality. The interpretation of observations has been complicated by the increased nutrient load of the surface water inlets, especially that which resulted from unseasonable heavy rains flushing large quantities of nutrient rich and biologically active waters stored behind a beaver dam during weeks 24 to 28, 1978.
W79-09232

2I. Water In Plants

MECHANICAL HARVESTING OF AQUATIC PLANTS; REPORT 1, FIELD EVALUATION OF THE AQUA-TRIO SYSTEM,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. M. Culpepper, and J. L. Decell.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 932, Price codes: A06 in paper copy, A01 in microfiche. Technical Report A-78-3, October 1978, in two volumes. 406 p, 6 append, 2 pl, 7 tab, 36 ref.

Descriptors: *Aquatic plants, *Aquatic weed control, *Harvesting, *Aqua-Trio.

The U.S. Army Engineer District, Jacksonville, is instituting environmentally compatible, large-scale aquatic plant control and management programs. Local opposition to the use of chemicals to control waterhyacinths and the lack of a federally registered chemical to control the submersed aquatic plant hydrilla prompted the Jacksonville District to request that the U.S. Army Engineer Waterways Experiment Station evaluate the most advanced off-the-shelf aquatic plant harvesters and harvesting systems. The only equipment found with the potential to meet specified requirements is a three-component mechanical harvesting system, known as the Aqua-Trio, manufactured by Aquamarine Corporation of Waukesha, Wisc. This report reflects the results of the field data collection program and the analysis of the equipment performance. The main text and Appendixes A-E are contained in Volume I. Volume II contains Appendix F, which is a compilation of all data taken and equipment operating times recorded during the field operation. (WES)
W79-09093

2J. Erosion and Sedimentation

BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND,
Corps of Engineers, Washington, DC. Beach Erosion Board.
For primary bibliographic entry see Field 2L.
W79-09138

SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS, COMPILATION REPORT OCTOBER 1971-SEPTEMBER 1975,
Texas Dept. of Water Resources, Austin.
J. P. Dougherty.
Report 233, May 1979. 88 p, 1 fig.

Descriptors: *Sediment discharge, *Suspended load, *Data collections, *Texas, Suspended solids, Sediments, Sediment transport, Streamflow, River basins, Water year, On-site data collections, Rivers, Reservoirs.

This report was a supplement to Texas Water Development Board Reports 184, 106, and 45, Texas Water Commission Bulletin 6410, and Texas Board of Water Engineers Bulletin 6108. These prior publications presented the results of suspended-sediment load measurements at permanent observation points from the beginning of record through the 1971 water year. No reconnaissance-type determinations of short-period record or intermittent record were compiled. During the period covered by this report, 39 suspended-sediment sampling stations were operated in 12 river basins. No attempt was made to include that sediment which may be moved by a flowing stream along its bottom, commonly referred to as 'bed load.' Presented with the sediment data obtained for the 1972 through 1975 water years was a summary table showing maximum, minimum, and average annual suspended-sediment transport passing each gaging point for a total period in full water years. Monthly values of sediment conversions to acre-feet were rounded to the nearest whole number and were based on a density of 70 pounds per cubic foot. (Humphreys-ISWS)
W79-09140

LABORATORY MEASUREMENTS OF UPWELLED RADIANCE AND REFLECTANCE SPECTRA OF CALVERT, BALL, JORDAN, AND FELDSPAR SOIL SEDIMENTS,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
For primary bibliographic entry see Field 7B.
W79-09150

PROBLEM ASSESSMENT REPORT: SOIL EROSION SUBCOMMITTEE--ILLINOIS AGRICULTURAL TASK FORCE ON NON-POINT SOURCES OF POLLUTION.
Illinois Inst. of Natural Resources, Springfield.
Final Report, Soil Erosion Subcommittee, April 24, 1978. 76 p, 7 fig, 17 tab, 69 ref.

Descriptors: *Sedimentation, *Erosion, *Sediments, *Suspended solids, *Illinois, Turbidity, Nutrients, Nitrogen, Phosphorus, Potassium, Surveys, Sampling, Soil erosion, Agriculture, Bacteria, Pollutants, Path of pollutants, Sediment transport, Streams, Rivers, Lakes, Land use, Aquatic habitats.

Before Illinois was widely settled, the rivers and streams were usually described as being clear. The land was generally vegetated with forest and prairie that soaked up rainfall and released water slowly to streams and springs during dry seasons. Even with the development of agriculture in Illinois, many streams remained relatively clear until some time after 1900. The results of sedimentation surveys showed that there are regional differences in the sediment yields of different regions of the state. The sediment yield of the Galesburg Plain area is much higher than that of the Springfield Plain, or of the claypan soils. In most lakes, streams, and rivers in Illinois, turbidity produced by suspended sediment at certain times of the year is well within the range of 20 to 100 Jackson Turbidity Units--a range which is known to cause undesireable changes in aquatic life. Turbidity varies with the weather and the season. Sheet and rill erosion occurring on agricultural land is by far the largest source of sediment in Illinois. Urban land and land where mining or oil extraction is taking place may also suffer from erosion but are a source of less sediment than sheet and rill erosion. Gully and stream-bank erosion can occur on any land, but sediment arising from this source is minor in relation to the total. However, sediment from any source can cause severe problems at a specific location. Certain conservation practices can be applied to nearly level lands to reduce losses from soil erosion below the present level. However, these practices must be designed to maintain adequate drainage on such soils, which have an inherent drainage problem; otherwise, crop yields will be reduced. (Sims-ISWS)
W79-09164

MULTIPLE REGRESSION TECHNIQUE FOR ESTIMATION OF SUSPENDED SEDIMENT TRANSPORT IN KIZINGA RIVER OF COASTAL TANZANIA,
Dar es Salaam Univ. (Tanzania).
J. I. Matondo, and S. V. K. Sarma.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 17 p, 2 fig, 3 tab, 4 equ, 8 ref.

Descriptors: *Regression analysis, *Estimating, *Suspended sediment transport, *Hydrology, *Kizinga River basin(Tanzania), Coastal areas, Stochastic processes, Semi-arid basins, Groundwater resources, Watersheds(Basins), Simulation analysis, Mathematical models, Storm runoff, Hydrographs, Equations, Walling's approach, Hydraulics, Systems analysis.

Stochastic empirical models as applied to hydrological problems have been discussed. The hydrology of the Kizinga basin has been explained. The utility in applying multiple regression analysis for estimating suspended sediment in rivers is demonstrated, with reference to semi-arid basins of Coastal Tanzania. As the Kizinga River is a low-land stream with fine sand transport, the basin's potentiality as a groundwater resource has been stressed. The hydraulic theory of bed material transport is helpful but inadequate, so resort is made to investigate allied factors affecting the hydrology of the watershed by considering the individual storm events which result in single-peaked runoff hydrographs. In the present analysis, Walling's approach for small watersheds is made use of and the resulting equation--connecting the suspended load concentration expressed as percent of bed load by weight with the parameters describing rising or falling limbs of a storm runoff hydrograph--has been tested for its validity. The physical significance of the parametric variables has been explained. The regression equation enables one to calculate the relative amount of sediment transported at a given level of storm flow occurring at the time of sampling. A practical illustrative example has been furnished giving details to work out the coefficients. (See also W79-09285) (Bell-Graf--Cornell)
W79-09295

2L. Estuaries

BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND,
Corps of Engineers, Washington, DC. Beach Erosion Board.
R. A. Jachowski.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A037 880, Price codes: A03 in paper copy, A01 in microfiche. Miscellaneous Paper No. 2-59, May 1959. 32 p, 5 fig, 3 tab, 1 ref, 1 append.

Descriptors: *Groins(Structures), *Maryland, *Beaches, *Beach erosion, *Erosion control, Coasts, Coastal structures, Coastal engineering, Sands, Asphalt, Waves(Water), Ocean waves, Storms, Hurricanes, Erosion, Littoral drift, Engineering, *Ocean City(MD).

The ocean shore of Maryland northward from Ocean City to the Delaware State line has had a history of erosion over the past century. In 1954 and 1955, the Maryland State Roads Commission desired to stabilize this shore, and with limited funds available decided to experiment with sand-asphalt construction for a groin system. Although the groins were constructed with approximately 50% of their height (the highest being 3 1/2 to 4 feet) buried below the beach surface, storm wave profile adjustments caused exposure of the crowns and aprons of the groins. As a result, the groins were undermined and settled or were destroyed. After the storms, the beach slope readjusted and covered the seaward section of the groin, which had settled. With this portion of the crown covered, the groins were not able to retain littoral material. Three years after construction (October 1957) only 5 of the 43 groins were exposed above the beach level in the foreshore zone. The net effect of the entire groin system on the shore at the end of 3 years appears to have been negligible. The behavior of the sand-asphalt groins of the type used to date demonstrates definite limitations of effectiveness. Modification of design as to mix, dimensions, and sequence of construction may reveal a different behavior. (Sims-ISWS)
W79-09138

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME VI, APPENDIX 7, WATER QUALITY.
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 5A.
W79-09146

MODELLING THE WATER QUALITY IN NEVA BAY,
Akademiya Nauk SSSR, Moscow.
For primary bibliographic entry see Field 5B.
W79-09326

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF LOW PRESSURE BRACKISH-WATER REVERSE OSMOSIS MEMBRANES,
Abcor, Inc., Wilmington, MA. Walden Div.
R. L. Goldsmith, B. A. Wechsler, D. C. Grant, R. B. Parker, and M. H. Kleper.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 226, Price codes: A06 in paper copy, A01 in microfiche. Final Report, July 1979. 98 p, 45 fig, 6 append. OWRT (No. 7509)(1). 14-34-0001-7509(1).

Descriptors: *Membrane processes, *Reverse osmosis, *Brackish water, Demineralization, *Membranes, *Polybenzimidazolone, Optimization, Spiral module, Development, Evaluation.

Flat-sheet reverse osmosis membranes were developed for low pressure, brackish-water desalination from a novel, aromatic polymer polybenzimidazolone (PBIL). This polymer, developed in Japan, had been previously shown to have potential when formed into a seawater desalting membrane. Membrane formation conditions were systematically varied in order to tailor membrane characteristics to applications in brackish-water desalting. This work resulted in the formation of membranes with initial fluxes of 15-16 gfd and salt rejections of 90-95% using 0.5% sodium chloride at 250 psig and 25 C. Following the laboratory work, flat-sheet membrane was manufactured for fabrication of 2-inch diameter spiral-wound reverse osmosis modules. Although newly-manufactured membrane gave fluxes of 13 gfd or greater and rejections of 90%, results for modules were typically 5-7 gfd and 80-85%. Membrane performance losses during shipment, storage and module fabrication appeared to predominate in determining module performance although structural considerations in the modules themselves were also a factor.
W79-09314

3B. Water Yield Improvement

LEGAL IMPLICATIONS OF INCREASING THE AVAILABILE WATER,
Blatchley Associates, Inc., Denver, CO.
For primary bibliographic entry see Field 6E.
W79-09173

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 6E.
W79-09175

3C. Use Of Water Of Impaired Quality

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 6E.
W79-09175

STATUS OF INORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
L. E. Sommers, D. W. Nelson, and L. B. Owens.
Soil Science, Vol. 127, No. 6, p 340-350, June 1979. 3 fig, 7 tab, 31 ref. OWRT B-075-IND (3).

Descriptors: *Phosphorus, *Soils, *Irrigation, *Waste water(Pollution), *Pennsylvania, Carbon, Nitrogen, Effluents, Sampling, Leachate, Sorption, Water reuse, Laboratory tests, Wastewater irrigation.

A cooperative study was conducted with Pennsylvania State University to assess the effects of wastewater irrigation on the status of soil phosphorus. The major objective of the research was to evaluate the influence of wastewater irrigation on changes in soil organic carbon, nitrogen, and phosphorus and the sorption of orthophosphate (P). Soil samples were obtained in 1974 and 1975 from Hublersburg silty clay loam cropped to corn, Reed canarygrass, or a mixed forest and from a Morrison sandy loam with a mixed forest stand. The sites had been irrigated with secondary effluent for 11 to 12 years. Soil analyses indicated that the majority of phosphorus added to soils during wastewater irrigation remained in the upper 30 cm of the Hublersburg clay loam soil. In contrast, appreciable amounts of P had leached to the 30 to 60-cm depth in the Morrison sandy loam. The equilibrium phosphate concentration (EPC) increased markedly at the 0 to 15-cm depth as a result of wastewater irrigation, due to sorption of P added in the wastewater. As expected, the maximum P sorption capacity of soils was decreased by wastewater irrigation. A comparison of soluble P levels in leachate samples collected in the field at a 120-cm depth with soluble P predicted by EPC measurements indicated that laboratory measurements overestimate the ability of a soil to remove P from wastewater. (Viscocky-ISWS)
W79-09234

3D. Conservation In Domestic and Municipal Use

CONSERVATION ECONOMICS OF HAWAII'S SYSTEM OF WATER RIGHTS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W79-09182

3F. Conservation In Agriculture

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09181

THE ECONOMIC IMPLICATIONS OF EROSION AND SEDIMENTATION CONTROL PLANS FOR SELECTED PENNSYLVANIA DAIRY FARMS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
G. B. White, and E. J. Partenheimer.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 341-357, 1979. 6 tab, 8 ref.

Descriptors: *Erosion control, *Sediment control, Economic impact, *Dairy industry, Water law, Soil conservation, Linear programming, *Pennsylvania.

Amendments to the Clean Streams Law of Pennsylvania required the state's agricultural landowners to have erosion and sedimentation control plans implemented by July 1, 1977. The purpose of this research was to investigate the effects of implementation on the income of commercial dairy farms. The research focused on conservation plans made by the Soil Conservation Service (SCS) for twelve case study farms. Linear programming was used to estimate returns to fixed resources and farm organization for three plans for each farm. These included the base plan, before implementation of the SCS plan; the farm plan incorporating SCS recommendations; and a plan incorporating no-till corn production as an alternate or supplement to other conservation practices. (See also W79-09185) (Skogerboe-Colorado State)
W79-09210

FARM-LEVEL ECONOMIC EVALUATION OF EROSION CONTROL AND REDUCED CHEMICAL USE IN IOWA,
Iowa State Univ., Ames. Dept. of Economics.
J. M. McGrann, and J. Meyer.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 359-372, 1979. 1 fig, 3 tab, 11 ref.

Descriptors: *Erosion control, Fertilizers, Pesticide toxicity, *Water pollution sources, Economic impact, Model studies, Linear programming, Terracing, Institutional constraints, *Iowa, Nonpoint sources.

This study concentrated on the farm-level economic impact of soil loss control and reduced chemical use. The farms analyzed are typical of three major soil associations in Iowa which cover a wide spectrum of farming conditions in the state. The analysis investigated the impact of restricting soil loss from the present to several reduced levels on net farm income and land rents for both specialized crop and mixed crop and livestock farms. The waste disposal problem of the limited sized livestock enterprises was not addressed in this study. A limited analysis was made of the effect that reducing fertilizer and banning pesticide use would have on farm income as an alternative to reduce nonpoint pollution. Policy alternatives to control erosion, including tax rates to achieve reduced soil loss and cost-sharing schemes for terracing, were evaluated in farm-level models. Consideration was also made as to how information generated in the study can be used for extensionist and farmer training. (See also W79-09185) (Skogerboe-Colorado State)
W79-09211

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

HYDROLOGIC ENGINEERING METHODS FOR WATER RESOURCES DEVELOPMENT, VOLUME 7, FLOOD CONTROL BY RESERVOIRS,
Hydrologic Engineering Center, Davis, CA.
L. R. Beard.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 598, Price codes: A06 in paper copy, A01 in microfiche. Report HEC-IHD-0700, February 1976. 98 p, 19 fig, 8 tab, 12 ref, 1 append.

Descriptors: *Flood control, *Reservoir operation, *Spillways, *International Hydrological Decade, Runoff, Storm runoff, Snowmelt, Storage capacity, Reservoirs, Design, Reservoir design, Inflow, Discharge(Water), Structures, Outlet works, Mathematical models, Computer models, Analytical techniques, Rule curves.

This was Volume 7 of a 12-volume report prepared by The Hydrologic Engineering Center as a part of the Army Corps of Engineers' contribution to the International Hydrological Decade. Basic principles of reservoir operation for flood control were presented, and procedures for establishing operational criteria were described. Topics included determination of reservoir release rates, regulation of the reservoir design flood, considerations for determining outlet and spillway regulation, determination of rule curves, and procedures for analyzing multiple-reservoir operation. The applicability of computer simulation for establishing operational criteria was discussed. (Sims-ISWS)
W79-09145

STATE WATER LAWS: EFFECT ON ENGINEERING SOLUTIONS,
Army Engineer District, Galveston, TX.
C. E. Reinke, and R. C. Allison.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 204-218, 1979.

Descriptors: *Surface-groundwater relationships, *Water supply development, *State governments, *Water conservation, Water law, Water management, Water policy, Water pollution control, Aquifers, Surface waters.

Present state water rights laws generally address surface and groundwater as separate resources. This tends to discourage exercize of the best possible water resource management. This results in inefficient utilization of surface water and drainage of groundwater aquifers without constraints. Current state water rights laws were developed when people were not concerned with the interrelationship between surface and groundwater. The states were concerned only with determining who was entitled to the use of these waters. This was accomplished by surface water rights laws which were based on riparian rights or appropriation rights. Groundwater rights laws either followed the common law rule of absolute ownership or the doctrines of reasonable use and correlative rights. State water rights laws that treat surface and groundwater as distinct resources are no longer reasonable, since engineering advancements have disclosed the interrelationship and interdependence of all waters. Revisions of state water laws are suggested which would require conjunctive use of surface and groundwater in the interest of efficiency and conservation. (Vloedman-Florida)
W79-09179

Group 4A—Control Of Water On The Surface

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W79-09180

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09181

BYZANTINE DRAINAGE LAW: PENNSYLVANIA'S EXPERIENCE,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 6E.
W79-09183

SIMULATION OF THE WATER MOVEMENT AND THE CHLORIDE CONTENT IN A CANAL-OPEN RESERVOIR SYSTEM,
Technische Hogeschool Twente, Enschede (Netherlands). Dept. of Chemical Engineering.
B. H. Tangena, J. G. de Graan, and F. Langeweg.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 20 p, 8 fig, 18 equ, 1 append.

Descriptors: *Simulation analysis, *Water movement, *Chloride content, *Reservoirs, *Twente Canal(The Netherlands), *Mathematical models, *Hydrologic data, Computer programs, Reservoir operation, Water balance, Statistical methods, Logistics, Drinking water, Flow, Sensitivity analysis, Equations, Systems analysis.

In order to study the possibilities of a surface water reservoir, for drinking water supplies, in the Twente district in the Netherlands, which is fed by the Twente canal or Twentes' brooks, a mathematical model was developed. The model describes the flow and chloride concentration in the canal and the reservoir as a function of time. Input data are measured hydrological data generated over a period of 37 years. The model seems quite insensitive to inaccuracies in this data. By verification, the model gives a very reasonable description of reality, both with relation to the water and the chloride balance. It is concluded that based on the model computations, reliable pronouncements can be made for expected level fluctuation and spanning periods in a reservoir in the Twente district. (See also W79-09285) (Bell-Graf--Cornell)
W79-09301

A COMPUTER SIMULATION MODEL FOR THE MANAGEMENT OF LAKE MAGGIORE WATER SYSTEM,
Politechnico di Milano (Italy). Ist. di Elettrotecnica ed Elettronica.
G. Ambrosino, G. Fronza, and R. Soncini-Sessa.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprintsj of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 20 p, 7 fig, 3 tab, 9 ref, 5 equ.

Descriptors: *Simulation analysis, *Computer models, *Management, *Lake Maggiore(Italy), Regulation, Least squares method, Effects, Reservoir releases, Floods, Recreation, Mathematical models, Systems analysis, Equations, Multiple-purpose reservoirs, Operating rule, Interpretative model.

This paper describes an interpretative model of the present 'empirical' regulation of the Lake Maggiore system. Precisely, the existence of an operating rule in the form of a complex multiseasonal yield-level relationship is postulated, and the rule is identified out of past management figures via a modified least squares interpolation technique. Then the model, suitably adjusted, is run in order to point out the effects (on downstream release deficit as well as on floods on the lake sides, where recreational activities are located) of enhancing the present regulation range, namely the range above which the outflow gates must be kept open by law. (See also W79-09285) (Bell-Graf--Cornell)
W79-09306

LEGAL RESTRAINTS AND RESPONSES TO THE ALLOCATION AND DISTRIBUTION OF WATER,
Denver Univ., CO.
For primary bibliographic entry see Field 6E.
W79-09316

TRANSMOUNTAIN DIVERSIONS OF WATER IN COLORADO,
Moses, Wittemeyer, Harrison and Woodruff Boulder, CO.
For primary bibliographic entry see Field 6E.
W79-09318

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
G. Sarlie, and G. Wallace.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 414, Price codes: A04 in paper copy, A01 in microfiche. September, 1976, 47 p.

Descriptors: *Washington, *Water rights, *Water resources, *Water management, Legislation, Water policy, Water allocation, Groundwater, State governments, Water conservation.

In April, 1976, Governor Evans of Washington initiated a statewide Policy Analysis Process. It requested that state agencies devote a part of their analytical resources to policy questions of special importance to central management decisions. This report is a response to a request for a water rights issue analysis. The analysis includes the increasing problems surrounding the water rights question and the need for reassessment of the use of public waters, and recommendations aimed at improving water right management. At the time this report was being written, the Department of Ecology adopted chapter 173-596 WAC, Procedures and Policies Governing Appropriations of Significant Amounts of Water for Agricultural Irrigation Use. This term permit regulation answers many questions concerning water right management. The report contains a copy and an explanation of chapter 173-596 WAC. Also included is a copy of Washington's 1971 Water Resources Act, which sets forth fundamentals of water resource policy to insure the protection and full utilization of the state's water. A brief history of Washington's water rights is presented. (Vloedman-Florida)
W79-09319

4B. Groundwater Management

GEOMORPHIC PERSPECTIVE ON SHALLOW GROUNDWATER POTENTIAL, COASTAL NORTH-EASTERN TASMANIA,
Tasmania Univ., Hobart (Australia). Dept. of Geography.
A. R. Bowden.
Australian Water Resources Council Technical Paper No. 36, 1978. 87 p, 37 fig, 8 tab, 42 ref. Australian Government Publishing Service, Canberra. 75/84.

Descriptors: *Groundwater potential, *Groundwater mining, *Water supply, Geomorphology, Geology, Water utilization, Australia, Groundwater, Pumping, Irrigation water, Tasmania, Flow, Aquifers, Groundwater resources, Excavation, Tomahawk Formation, Barnbougle Member.

Hydrological processes in coastal areas of north-eastern Tasmania were studied, and coastal sediment bodies were classified as potential aquifers on the basis of their form, stratigraphy, sedimentary, and physical characteristics insofar as these properties can be related to the storage transfer and yield of groundwater. Mapping and description of landforms and deposits was followed by intensive examination of the hydraulic properties of the sedimentary body which was expected to have the highest potential as a groundwaters reservoir. The groundwater potential of the Tomahawk Formation and Barnbougle Member were highlighted by the study. The Tomahawk Formation has sufficient groundwater to supplement the relatively low summer rainfall; this water is near the surface. The Barnbougle Member has abundant water of a potentially higher quality than that of the Tomahawk Formation. An efficient pumping method utilized 5 cm diameter wire around screens jetted into the sand. An array of screens in areas where sands are more than 4 m thick, each yielding 20,000 liters/day, would provide ample local irrigation water. Shallow excavations for livestock watering should be carried out when the water table is very low. (Schaefer-IPA)
W79-09081

STATE WATER LAWS: EFFECT ON ENGINEERING SOLUTIONS,
Army Engineer District, Galveston, TX.
For primary bibliographic entry see Field 4A.
W79-09179

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W79-09180

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09181

STATUS OF INORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 3C.
W79-09234

THE USE OF A GROUNDWATER MODEL IN THE DESIGN, PERFORMANCE ASSESSMENT AND OPERATION OF A RIVER REGULATION SCHEME,
Water Research Centre, Marlow (England). Medmenham Lab.
M. W. Liddament, D. B. Oakes, A. C. Skinner, and W. B. Wilkinson.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Univesita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 24 p, 8 fig, 2 equ, 6 ref.

Descriptors: *River regulation, *Groundwater, *Mathematical models, *Design, *Performance assessment, *Management, *Planning, *Computers, *Costs, Operations research, Pumping, Aquifers, Equations, Flow augmentation, Abstraction, River Severn(GB), Water demand, Simulation analysis, Water allocation(Policy).

The River Severn forms a vital part of the water supply of the West Midlands in the United Kingdom. Demand from this river is increasing and is estimated to exceed the present reliable yield by 225 Ml/d by the late 1980's. To cope with this shortfall, it is proposed to regulate flow by pumping groundwater from the Triassic sandstone of North Shropshire into the river. An integral part of the resource study of this aquifer has been the development of a mathematical groundwater model. This paper describes how the model has contributed to the design of the scheme and its use in assessment of performance and operational management. It also describes the setting up of the

model, its data and computer requirements, cost of operation and benefits. It is shown that the cost of model development is small in relation to the overall cost of the scheme and that the benefits of the model will increase as the load factor on the groundwater increases. (See also W79-09285) (Bell-Graf--Cornell)
W79-09308

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

4C. Effects On Water Of Man's Non-Water Activities

INTERRELATING LAND AND WATER MANAGEMENT IN FLORIDA,
For primary bibliographic entry see Field 6E.
W79-09176

SIMULATION OF STORMWATER RUNOFF AND SEDIMENT YIELD FOR ASSESSING THE IMPACT OF SILVICULTURE PRACTICES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. M. Li, K. G. Eggert, and D. B. Simons.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 295-307, 1979. 6 fig, 11 ref.

Descriptors: *Watershed management, *Water yield, *Sediment yield, Forest management, Model studies, Simulation analysis, Storm runoff, *Forest practices.

During the past two decades several watershed modeling techniques have been developed to allow the prediction of water and sediment yield. The estimations of infiltration, runoff and sediment yield are the major process components required for simulating watershed response. These process models, when based on sound physical reasoning are generally recognized as an important predictive tool in assessing the impact of land use and silviculture management schemes on the environment. Unfortunately, these models are often necessarily complex in formulation and require considerable expertise and computer time to achieve reasonable results. Therefore, although quite accurate, their complexity often seems to inhibit their utility. In order to generate an answer quickly and with reasonable expenditure, easier techniques such as the basin recharge method, the unit hydrograph and the Universal Soil Loss Equation are often used despite their deficiencies. The simple watershed model presented in this paper combines the advantages of a nonlinear, physically based approach with the utility of an interactive format. (See also W79-09185) (Skogerboe-Colorado State)
W79-09206

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

4D. Watershed Protection

PHYSICAL MODEL OF THE HYDROLOGY OF SLOPING HETEROGENEOUS FIELDS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 2G.
W79-09161

THE ECONOMIC IMPLICATIONS OF EROSION AND SEDIMENTATION CONTROL PLANS FOR SELECTED PENNSYLVANIA DAIRY FARMS,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W79-09210

FARM-LEVEL ECONOMIC EVALUATION OF EROSION CONTROL AND REDUCED CHEMICAL USE IN IOWA,
Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 3F.
W79-09211

ECONOMIC IMPACTS OF POLICIES TO CONTROL EROSION AND SEDIMENTATION IN ILLINOIS AND OTHER CORN-BELT STATES,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
W. D. Seitz, C. Osteen, and M. C. Nelson.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 373-382, 1979. 10 ref.

Descriptors: *Erosion control, *Sediment control, Soil erosion, Economic impact, Agricultural watersheds, Linear programming, Water pollution control, Water quality control, Corn belt, Nonpoint sources.

This paper addressed (1) the costs to society of controlling agricultural nonpoint sources of pollution, specifically erosion and sedimentation, and (2) the variation in economic impacts as states or/and areas enact varying levels of control. A large linear programming model of the corn-belt region which accounts for variable corn and soybean production and prices was used in the analysis. This model was used to evaluate alternative erosion control policies implemented in selected areas of the corn belt. At the corn belt level, impacts on social cost, farm income, food costs, commodity prices and production, land use, and soil loss were discussed. The analysis of varying controls by areas was measured in terms of impacts on the comparative advantage, farm income, crop production, land use and soil loss of controls applied in Illinois and Wisconsin. The paper also reported the results of an analysis of the long-run impacts of soil erosion and soil erosion control policies on farm income. This analysis was conducted on a representative watershed using a series of linear programming models with adjustments to reflect the impacts of erosion on productivity. (See also W79-09185) (Skogerboe-Colorado State)
W79-09212

PROCEDURE FOR ECONOMIC EVALUATION OF BEST MANAGEMENT PRACTICES,
Soil Conservation Service, Washington, DC.
T. H. Dempster, and J. H. Stierna.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 383-391, 1979. 1 fig, 1 tab, 3 ref.

Descriptors: *Soil conservation, *Soil erosion, Management, Economic impact, Environmental effects, Water pollution control, Water quality control, Farm practices.

Evaluation procedures for best management practices (BMP) were discussed with emphasis on alternative practices affecting water conservation and quality, and production efficiency. Onsite and offsite resource problems that were identified and measured, include those related to reduced agricultural production and increased production and maintenance costs per unit of output which can result from erosion, sedimentation, impaired water quality and reduced soil moisture. Quantified data from the use of universal soil loss equation, research studies of extension, universities and Agricultural Research Services (ARS), and compiling of experienced crop yields were evaluated with computerized methods such as the Crop Budget System (CBS), linear programming and value of agricultural production. CBS is a system designed for efficient storage, rapid retrieval, use and revision of crop budgets used to evaluate alternative systems of BMP. Qualifying statements on nonmonetary impacts, primarily environmental issues, were also discussed. Procedures describing the estimation of installation, operation and maintenance costs of BMP were included, as well as methods to assess income foregone and adverse environmental effects. (See also W79-09185) (Skogerboe-Colorado State)
W79-09213

AN ECONOMIC ANALYSIS OF EROSION CONTROL OPTIONS IN TEXAS,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
D. R. Reneau, and C. R. Taylor.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 393-418, 1979. 4 fig, 8 tab, 11 ref.

Descriptors: *Erosion control, Soil erosion, Economic impact, *Sediment control, Water pollution control, Water quality control, Model studies, *Texas, Nonpoint sources, Farm practices.

A model for estimating the changes in farming practices, farm income, soil loss, offsite sediment damages, and social welfare over a long planning horizon for a watershed under various nonpoint source control options was presented. The model was sufficiently general to permit the study of several possible nonpoint source control options, including: (a) per acre soil loss limits; (b) soil loss taxes; (c) conservation practice cost sharing arrangements; and (d) combinations thereof. On-farm economics of conservation was imbedded in the model. Results from this modeling approach for Lavon Reservoir Watershed were presented. Included were the estimated changes in farming practices, farm income, soil loss, and off-site sediment damages for the selected nonpoint source control options. (See also W79-09185) (Skogerboe-Colorado State)
W79-09214

ECONOMIC, INSTITUTIONAL AND WATER QUALITY CONSIDERATIONS IN THE ANALYSIS OF SEDIMENT CONTROL ALTERNATIVES: A CASE STUDY,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
B. M. H. Sharp, and S. J. Berkowitz.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 429-453, 1979. 6 fig, 8 tab, 20 ref.

Descriptors: *Sediment control, Economic impact, *Institutional constraints, Linear programming, Soil conservation, Sediment yield, Sediment load, Model studies, Decision making.

Traditional economic analyses of the impact of conservation policies on the farm firm have relied solely upon the establishment of soil loss constraints to induce compliance. There are, however, different approaches to inducing a pattern of behavior which are also consistent with achieving the desired reduction in sediment. These policy options also have differing economic, institutional and water quality implications. The results of a study, conducted in a 440 acre watershed in Washington County, Wisconsin, which explicitly recognizes a set of institutional alternatives designed to modify operator behavior, were presented. In addition, the water quality implications of these alternatives with respect to sediment loads were illustrated. (See also W79-09185) (Skogerboe-Colorado State)
W79-09216

DEVELOPMENT OF BMPS FOR AGRICULTURE-NEW YORK STATE STRATEGY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W79-09224

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

TOXICITY OF PULP AND PAPER MILL EFFLUENT: A LITERATURE REVIEW,
Corvallis Environmental Research Lab., OR.
F. F. Hutchins.
U. S. Environmental Protection Agency, EPA-600/3-79-013, February, 1979. 7 tab, 146 ref.

Descriptors: *Pulp wastes, *Pulp and paper industry, Toxicity, Bioassay, Laboratory tests, Industrial wastes, *Water pollution effects, Freshwater fish, Physiological effects, Marine fish, Waste treatment, Sulfite pulping wastes, Kraft pulping wastes, Groundwood pulp, Sublethal effects, *Resin acids, Environmental effects, Toxic compounds.

Untreated pulp and paper mill effluents are very toxic to most aquatic life. Concentrations as low as two percent can be acutely toxic to fish. Sufficient treatment can render the effluent nontoxic much of the time; however, treatment processes used by most mills reduce toxicity but do not eliminate it. Even effluents receiving 'good' treatment may exhibit sporadic and dynamic increases in toxicity (due in part to spills or dumping of spent pulping chemicals). Sublethal exposures to aquatic organisms to pulp effluent may affect a number of their physiological and behavioral functions. The principal toxic components in pulp and paper mill effluents are resin acids and fatty acids naturally occurring in the wood pulp and, in effluents from bleaching processes, toxic chlorinated compounds predominate. Untreated effluents have caused considerable environmental damage, but well-treated effluents have had minimal effects on fish production, although shifts in biological diversity have occurred. (Katz-EIS)
W79-09097

THE EFFECT OF MERCURIC CHLORIDE ON SOME BIOCHEMICAL INDICATORS OF THE BRAIN, BLOOD AND LIVER OF THE 'CASPIAN ROACH', RUTILUS RUTILUS CASPICUS,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Makhachkala (USSR). Dagestanskii Div.
For primary bibliographic entry see Field 5C.
W79-09099

ARSENIC AND OTHER TRACE ELEMENTS IN THE WATERS AND ORGANISMS OF AN ESTUARY IN SW ENGLAND,
Westfield Coll., London (England).
D. W. Klumpp, and P. J. Peterson.
Environmental Pollution, Vol. 19, p 11-20, 1979. 2 fig, 6 tab, 27 ref.

Descriptors: *Arsenic, *Trace elements, *Estuaries, *Path of pollutants, *Bioaccumulation, *Water quality, *Benthos, Zinc, Copper, Cadmium, Metals, Estuarine environment, Intertidal areas, Carnon River(England), Ostrea, Oysters, Shellfish, Public health, Mussels, Aquatic plants, Fucus.

Arsenic, cadmium, copper and zinc occur at elevated levels in the waters of Carnon River and the upper reaches of Restronguet Creek, these concentrations decreasing progressively towards the estuary of Carrick Roads. While arsenite is the main form of As in the Carnon River, this is converted to arsenate in the lower estuary. Organisms analysed from Restronguet Creek reflect the As concentration in the water, this being most clearly evident in macrophytes. Although accumulated at all trophic levels, there was no evidence for biomagnification of As on an entire organism basis. The As was shown to exist in selected organisms as a compound(s) which forms on hydrolysis, dimethylarsinate and traces of arsenate and methylarsonate. (Katz-EIS)
W79-09103

METAL ACCUMULATION BY AQUATIC BRYOPHYTES FROM POLLUTED MINE STREAMS,
Westfield Coll., London (England).
M. A. S. Burton, and P. J. Peterson.
Environmental Pollution, Vol. 19, p 39-46, 1979. 1 fig, 6 tab, 18 ref.

Descriptors: *Lead, *Zinc, *Mine wastes, *Path of pollutants, *Aquatic bryophytes, *Bioaccumulation, Mining industrial wastes, Water pollution sources, Water pollution, Aquatic plants, Streams, Liverworts, Monitoring, Zinc ions, Wales.

Analytical data are presented for metal concentrations in aquatic bryophytes growing in the streams of a lead-zinc mining area in Dyfed, Wales. The highest concentrations of zinc (7023 ppm/dry weight) and of lead (16,000 ppm/dry weight) were recorded in plants growing nearest the mines, reflecting the extent of metal pollution in the water. The widespread occurrence of some species in these areas suggests a wide range of tolerance. The chemical form of zinc in stream water from the Frongoch mine, in which the zinc concentration was 58 ppm, was demonstrated to be Zn(++). (Katz-EIS)
W79-09104

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,
Provinciale Waterstaat van Gelderland Arnheim (Netherlands).
B. de Boer.
Hydrological Sciences - Bulletin des Sciences, Hydrologiques Vol. 24, p 199-211, 1979. 8 fig, 14 ref.

Descriptors: *Model studies, *Phytoplankton, *Biochemical oxygen demand, *Sewage effluents, *Sewage treatment, *Dissolved oxygen, Methodology, Mathematical models, Pollution abatement, Forecasting, Rivers, Aquatic environment, Water pollution effects, Water pollution sources, Oxygen, Water quality control, Streams, Water management(Applied), Agricultural runoff.

The model presented has the purpose of predicting the effects of water resources management measures like sewage treatment, land fertilizer reduction and water level control on the oxygen and phytoplankton dynamics in a stream. A dynamic, one-dimensional model of the behaviour of BOD, a plant nutrient, phytoplankton and oxygen is given. The processes described are local discharges like the effluent from sewage treatment plants, distributed discharges, extractions, advection, dispersion, photosynthesis and respiration by phytoplankton, respiration of bacteria (BOD-decay), use and return of nutrients, distributed reaeration and reaeration at weirs. A method of characteristics (nodes moving with the stream velocity) is chosen to prevent numerical dispersion in a flexible way, i.e. the dispersion coefficient and the stream velocity may vary with place and time, and are limited by the place and time step values acceptable, like the other inputs. Thus, realistic modelling is possible without the large computing times required by steady grid methods if the dispersion is low. This situation occurs frequently in the Netherlands. (D. Katz-EIS)
W79-09108

INFLUENCE OF STOCK DENSITY AND FOOD USED ON GROWTH OF CARP KEPT IN COOLING WATERS,
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
R. Trzebiatowski, J. Filipiak, and R. Jakubowski.
Acta Ichthyologica et Piscatoria, Vol. 8, No. 1, p 43-53, 1978. 5 fig, 4 tab, 6 ref.

Descriptors: *Aquiculture, *Cooling water, *Fish diets, *Carp, *Fish populations, *Aquatic productivity, *Growth rates, Fish farming, Fish management, Fish stocking, Density, Productivity, Population, Freshwater fish, Size, Nutrients, Dolna Odra Power Station.

The results of studies on the influence of various stock densities and foods differing in their chemical composition on the growth of fishes kept in cages placed in the Dolna Odra power station cooling waters. Optimal stock densities for cage-rearing carp (C2-3) in cooling waters range within 100-140 ind. per cubic meter. Granule diameter of the granulated food should be gradually increased with fish growth, which is one of the prerequisites for an economical utilisation of fish food. In an intensive rearing of carp in cooling waters, it is possible to use foods of about 20 percent protein content. This indicates a possibility of manufacturing much cheaper foods and of utilizing their protein content in a much more economical way. (D. Katz-EIS)
W79-09109

EFFECT OF WATER TEMPERATURE ON THE INFECTION OF RAINBOW TROUT SALMO GAIRDNERI RICHARDSON WITH INFECTIOUS HAEMATOPOIETIC NECROSIS VIRUS,
Oregon State Univ., Corvallis. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W79-09111

THE EFFECT OF PH ON OXYGEN CONSUMPTION AND ACTIVITY IN THE BATHYPELAGIC MYSID GNATHOPHAUSIAINGENS,
California Univ., Santa Barbara. Dept. of Biological Sciences.
T. J. Mickel, and J. J. Childress.
Biological Bulletin, Vol. 154, p 138-147, 1978. 4 fig, 1 tab, 20 ref.

Descriptors: *Hydrogen ion concentration, *Oxygen, Dissolved oxygen, *Zooplankton, Animal physiology, *Respiration, Oxygen demand, Oxygen requirements, Crustaceans, Mysids, Bioassay, Methodology, Laboratory tests, Oxygen consumption, Animal behavior.

Pleopod beat of Gnathophausia ingens was unaffected by pH at pH 7.1 and pH 7.9 but was lower at pH 8.7 due to increased cleaning activity. The relationship between oxygen consumption rate and activity was unaffected by pH in the range of pH 7.1 and pH 8.7. The percent O2 extraction of oxygen by G. ingens was not statistically different at pH 7.9 and pH 8.7, but was greater at pH 7.1. The ability of G. ingens to regulate its oxygen consumption was unaffected by pH in the range studied. Since the increase in percent O2 extraction at pH 7.1 does not improve the ability of G. ingens to regulate its oxygen uptake, it appears that there is a loss in effectiveness elsewhere in its respiratory system at this pH. (Deal-EIS)
W79-09112

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE THIRD U.S.-JAPAN EXPERTS' MEETING--NOVEMBER 1977--EASTON, MARYLAND,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 777, Price codes: A14 in paper copy, A01 in microfiche.
U. S. Environmental Protection Agency, Report No. EPA-600/3/78-084, 312 p, 1978. Peterson, S. A. and Randolph, K. K., Editors.

Descriptors: *Bottom sediments, *Water quality control, *Bioaccumulation, Sediments, Metals, Heavy metals, Polychlorinated biphenyls, Chemical wastes, Industrial wastes, Dredging, Turbidity, Eutrophication, Bioassay, Benthic fauna, Water quality standards, Chemical analysis, Pesticides.

The United States-Japan Ministerial Agreement of May 1974 provided for the exchange of environmental information in several areas of mutual concern. This report is the compilation of papers presented at the Third U.S.-Japan Experts' Meeting

on the Management of Bottom Sediments Containing Toxic Substances, one of the 10 identified problem areas. The first meeting was held in Corvallis, Oregon, in November 1975. The second meeting was hosted by the Japanese Government in October 1976. The third meeting (at which these papers were presented) was held in November 1977 in Easton, Maryland. (See W79-09114 thru W79-09130) (Deal-EIS)
W79-09113

TURBIDITY GENERATED BY DREDGING PROJECTS,
Ministry of Transport, Kobe (Japan). Bureau of Ports and Harbors.
O. Nakai.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 31-47, 1978. 12 fig, 5 tab, 2 app, 2 ref.

Descriptors: *Dredging, *Turbidity, *Mathematical models, *Japan, Channel improvement, Bottom sediments, Soils, Soil types, Phytoplankton, Photosynthesis, Fish behavior, Fish physiology, Particle size, Turbidity currents, Tides.

This paper discusses investigations into turbidity generated by dredging during port construction. The study was made by the Bureau of Ports and Harbors and the Port and Harbor Research Institute, Ministry of Transport from 1973 to 1976. Field investigations were conducted to develop a method for predicting the quantity of turbidity generated by various dredges in different kinds of soil. A turbidity generation unit (TGU) was calculated using the results of these field investigations. It is defined as the quantity of turbidity generated per unit volume of dredged material, and can be effectively used to predict the quantity of turbidity. (See also W79-09113) (Deal-EIS)
W79-09116

RECENT PROGRESS IN TECHNIQUES FOR MANAGING CONTAMINATED BOTTOM SEDIMENTS,
Japan Dredging and Reclamation Engineering Association, Tokyo.
H. Koba.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 49-64, 1978. 21 tab, 1 ref.

Descriptors: *Bottom sediments, *Management, *Water quality control, *Japan, Water quality standards, Regulation, Law enforcement, Chemical wastes, Industrial wastes, Mine wastes, Oil, Mercury, Polychlorinated biphenyls, Water chemistry, Waste treatment, Suspended solids, Dredging, Waste disposal.

In Japan many ports, rivers, lakes and marshes possess contaminated bottom sediments which create undesirable effects on the surrounding environment. The pollutants in these bottom sediments are traced to waste from manufacturing plants or mine tailings, urban sewage, agricultural effluents and other industrial or urban sources. The most effective solution to the problem is to control pollution at the original source, but this is usually very difficult or impractical. Therefore, the management of contaminated bottom sediments has to be implemented in conjunction with countermeasures taken directly at the sources. This paper provides a brief introduction to recent progress on management techniques for contaminated bottom sediments. (See also W79-09113) (Deal-EIS)
W79-09117

DREDGING TOXIC SEDIMENTS IN YOKKAICHI PORT,
Yokkaichi Port Authority (Japan).
H. Ito.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 65-85, 1978. 7 fig, 1 tab.

Descriptors: *Dredging, *Bottom sediments, *Chemical wastes, *Japan, Industrial wastes, Sewage disposal, Waste disposal, Water quality control, Regulation, Water chemistry, Turbidity, Water pollution sources.

An outline of Japanese dredging projects to remove contaminated sediments was presented at the Second Conference held in Tokyo in October, 1976. This paper is a followup to report on the actual dredging work taking place in Yokkaichi Port. It is important to carefully investigate the area to be dredged. When this project began we found that vinyl, tires, steel wires, and other trash would clog the dredge pipe and this unexpectedly lowered the dredging capacity and prolonged the work. Sometimes the measured values of the biological indices at the monitoring points exceed the standards, but not due to reasons caused by dredging. If this is the case it is not necessary to slow down or halt the work. The problem is to determine quickly and easily the cause of the high values. Usual causes are the red tide and organically-rich river water flowing into the areas. These may be effectively judged by visual means except where turbidity is high. Then only the surface is visible and a transmissometer may be used to establish the turbidity, particularly around the dredging site, after which the dredging effect may be accounted for and the excess attributed to the other causes. (See also W79-09113) (Deal-EIS)
W79-09118

ACCUMULATION OF METHYL MERCURY IN RED SEA BREAM (CHRYSOPHRYS MAJOR) VIA THE FOOD CHAIN,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
M. Fujiki.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 87-94, 1978. 4 tab.

Descriptors: *Mercury, *Food chains, *Bioaccumulation, *Tissue analysis, *Bream, *Chrysophrys, Chemical analysis, Diatoms, Copepods, Juvenile growth stage, Absorption, Fish, Physiology, Path of pollutants, Water chemistry, Bioassay.

Accumulation of methyl mercury in red sea bream (Chrysophrys major) results from food chain accumulations--from diatoms to copepoda to the juvenile bream. Diatoms were reared for 24 hours in filtered sea water containing 5.0 ppb methyl mercury. Methyl mercury taken up by the diatoms reached a concentration of 3.45 ppm. The diatoms containing methyl mercury were then fed to the copepoda for 4 days. The concentration of methyl mercury in the copepoda reached 3.14 ppm. The copepoda were then fed to the juvenile red sea bream for 10 days. Methyl mercury concentration in the fish reached 3.10 ppm. The concentration of methyl mercury in the diatoms and the copepoda was about 2,000 times as much as that of the culture solution. The increase of methyl mercury from food to fish was about one. However, the amount of methyl mercury taken up by the juvenile bream was about 120 times as much as that of the control. (See also W79-09113) (Deal-EIS)
W79-09119

AN OVERVIEW OF BOTTOM SEDIMENT PROBLEMS IN SAGINAW RIVER AND BAY, MARINETTE-MENOMINEE HARBOR, AND WAUKEGAN HARBOR,
Environmental Protection Agency, Chicago, IL. Region V.
K. E. Bremer.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 199-212, 1978. 2 fig, 5 tab, 3 ref.

Descriptors: *Bottom sediments, *Great Lakes, *Dredging, *Arsenic, *Tissue analysis, Polychlorinated biphenyls, Path of pollutants, Channel improvement, Lake Huron, Fish populations, Benthic fauna, Lake Michigan, Sediments, Waste disposal, Marinette-Menominee.

Three waterways in the Great Lakes were selected for an overview of their current toxicant problems in bottom sediments. The Marinette-Menominee Harbor has severe arsenic problems associated with leaching from an adjacent waste storage area. Polychlorinated biphenyl contamination of bottom sediments is common to both Saginaw River and Bay and Waukegan Harbor. Problems related to fish contamination, proper dredging techniques and disposal of bottom sediments are discussed. (See also W79-09113) (Deal-EIS)
W79-09125

IMPACTS ASSOCIATED WITH THE DISCHARGE OF DREDGED MATERIAL INTO OPEN WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
R. M. Engler.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 213-223, 1978. 25 ref.

Descriptors: *Dredging, *Waste disposal, Nutrients, Metals, Organic compounds, Absorption, Aquatic populations, Benthic fauna, Mathematical models, Spoil banks, Chemical analysis, Heavy metals, Chlorinated hydrocarbon pesticides.

With few exceptions, impacts of aquatic disposal are mainly associated with the physical effects. These possible effects are persistent, often irreversible, and compounding. Geochemically, releases are limited to nutrients with negligible release of toxic metals and hydrocarbons. Biochemical interactions are infrequent with no clear trends and elevated uptake of toxic metals and hydrocarbons are negligible to nonexistant. (See also W79-09113) (Deal-EIS)
W79-09126

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO THE MARINE MACROBENTHOS,
Corvallis Environmental Research Lab., OR.
R. C. Swartz, W. A. DeBen, and F. A. Cole.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 225-237, 1978. 1 fig, 4 tab, 9 ref.

Descriptors: *Bioassay, *Benthic fauna, *Bottom sediments, *Toxicity, *Polychaetes, Sediments, Amphipoda, Mollusks, Aquatic populations, Particle size, Suspended solids, Chemical analysis, Duwamish River, Washington, Houston ship canal, Texas, Bailey Creek, Virginia, Raritan River, New Jersey, Coos Bay, Oregon.

A bioassay has been developed to determine the acute toxicity of the settleable phase of dredged material to the marine benthos. Five benthic invertebrates representing different taxonomic and trophic positions were allowed to acclimate to control (non-polluted) sediment and were then covered by a layer of either test or control sediment. Mean survival after ten days of exposure was significantly different from the controls for sediment from the Duwamish River, WA; Houston Ship Channel, TX; Bailey Creek, VA; and Raritan River, NJ; but there was no significant difference for sediment from Coos Bay and the Skipanon River, OR. There were substantial differences in survival among the five test species. The most sensitive species was the infaunal amphipod, Paraphoxus epistomus. (See also W79-09113) (Deal-EIS)
W79-09127

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME VI, APPENDIX 7, WATER QUALITY.
Corps of Engineers, Baltimore, MD. Baltimore District.
Report No. FCR-77-006, December 1977. 250 p, 25

fig, 49 tab, 45 ref, 2 append.

Descriptors: *Chesapeake Bay, *Water quality, *Forecasting, On-site investigations, Surveys, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Rivers, Flow, Industrial wastes, Runoff, Urban runoff, Temperature, Dissolved oxygen, Hydrogen ion concentration, Coliforms, Sewage, Bays, Estuaries.

The Chesapeake Bay Study developed through the need for a complete and comprehensive investigation of the use and control of the water resources of the Bay Area. In the first phase of the study, the existing physical, biological, economic, social, and environmental conditions and problem areas were identified and presented in the Existing Conditions Report. The Future Conditions Report, of which this appendix is a part, presented the findings of the second or projections phase of the study. Included as a part of this second phase were: projections of future water resource needs and problem areas, general means that might best be used to satisfy those needs, and recommendations for future studies and hydraulic model testing. Consequently, this report constitutes the next step toward the goal of developing a comprehensive water resource management program for Chesapeake Bay. This volume focused on the quality of the Bay's water resource and the impacts other resources uses have had and will continue to make upon it. This appendix provided an assessment of existing conditions, identified water quality problem areas, and cited the federal and state agencies currently responsible for management of the Bay's water quality conditions. Based on projections of sewered populations and waste loadings developed by the various state agencies throughout the Bay Area, future needs and problem areas were then developed. Lastly, the means that might best be used to satisfy the projected water quality needs and recommendations for future water quality studies were identified. (Sims-ISWS)
W79-09146

ENVIRONMENTAL FATE OF SELECTED PHOSPHATE ESTERS,
Monsanto Co., St. Louis, MO.
For primary bibliographic entry see Field 5B.
W79-09162

RAPID SPECTROSCOPIC METHODS FOR TRACE ELEMENT INVESTIGATIONS IN NATURAL WATERS,
New South Wales Univ., Kensington (Australia). Dept. of Analytical Chemistry.
L. E. Smythe, and R. J. Finlayson.
Australian Water Resources Council, Technical Paper No. 32, 1978. 31 p, 1 fig, 14 tab, 23 ref.

Descriptors: *Trace elements, *Chemical analysis, *Spectroscopy, *Water quality, Chemicals, Analytical techniques, Chemistry, Pollutants, Water pollution, Pollutant identification, Heavy metals, Equipment, Instrumentation, Methodology.

The potential of some inherently rapid atomic spectroscopy-based systems for the chemical analysis of heavy metals in water has been assessed. The study included suitable pre-analysis metal concentration schemes, the use of arc and spark emission spectroscopy in the multi-element mode, and graphite furnace atomization and flame atomic absorption in the single element mode. In the latter part of the study, there was also a limited evaluation of inductively coupled plasma atomic emission spectroscopy. The design and evaluation of suitable concentration schemes (concentration factor approximately x20,000) were shown to improve the performance of emission spectroscopy for the chemical analysis of natural waters. Further development of such schemes would also be useful in speciation studies. Of the concentration schemes studied, promising results were obtained using activated charcoal. Other schemes studied suffered somewhat from the introduction of metallic impurities, even in purified reagents, resulting in high blank values. Inductively coupled plasma atomic emission spectroscopy was also shown to have good potential for the direct multi-element analysis of waters at the 1-10 micrograms/liter level. (Sims-ISWS)
W79-09165

THE IMPACT OF URBANIZATION ON THE DISTRIBUTION OF HEAVY METALS IN BOTTOM SEDIMENTS OF THE SADDLE RIVER,
Rutgers--The State Univ., New Brunswick, NJ. Dept. of Environmental Sciences.
W. G. Wilber, and J. V. Hunter.
Water Resources Bulletin, Vol. 15, No. 3, p 790-800, June 1979. 3 fig, 5 tab, 13 ref. OWRT A0505-N.J.(3), 14-34-0001-8032.

Descriptors: *Heavy metals, *Sediments, *Urbanization, *New Jersey, Particle size, Sediment transport, Chemical oxygen demand, Distribution patterns, Spatial distribution, Metals, Lead, Zinc, Copper, Nickel, Chromium, Cadmium, Iron, Manganese, Rivers, Pollutants, Water pollution, *Saddle River(NJ), *Lodi(NJ).

A three-year study has been conducted on a 4.6 mile stretch of the Saddle River near Lodi, New Jersey. The primary objectives of this investigation were (1) to provide baseline information on the concentration and distribution of heavy metals in bottom sediments of the Saddle River; (2) to qualitatively evaluate which parameters affect this distribution; and (3) to determine the effect of urbanization on the concentration and distribution of these materials. Significant enrichments of several heavy metals were observed in bottom sediments of the lower Saddle River near Lodi, New Jersey, as compared to the upper Saddle River. Attempts to correlate metal concentrations in bottom sediments with chemical-oxygen demand were not successful in demonstrating a relationship between these two factors. Metal concentrations were found to be strongly dependent upon particle size. In general, metal concentrations in bottom sediments increased with decreasing particle diameter. However, metals enrichment was observed to be considerably greater in the larger sediment fractions studied (greater than 420 microns) than the smaller sediment fractions as one proceeded downstream through the urban area. Since the larger sediment fractions are least affected by scour and transport, they may best reflect the effect of urbanization on the distribution of heavy metals over an extended period of time at a given location. (Sims-ISWS)
W79-09233

5B. Sources Of Pollution

OIL SPILLS IN A RIVER: A ONE-DIMENSIONAL MODEL,
Institut Prikladnoi Geofiziki, Moscow (USSR).
G. Th. Voznesensky.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 213-223, June 1979. 8 fig, 7 ref.

Descriptors: *Oil spills, *Rivers, *Model studies, Mathematical models, Flow, River flow, Dispersion, Open channels, Ice, Ice cover, Oil pollution, Water pollution, Distribution patterns, Spatial distribution, Pollutants, Path of pollutants.

A linear, one-dimensional model was proposed to describe the river pollution resulting from oil spills. Two interacting migratory forms, water surface pollution and water body pollution, were considered. In the coordinate system moving with the mean flow velocity, the equations for the pollutant distributions were reduced to the type of a heat conduction equation with distributed unsteady sources. The solutions for oil concentrations, obtained in the form of the 'heat potential' were considered in two particular cases: (1) an oil spill in an open channel; and (2) river pollution from drifting ice due to the melting of polluted ice. (Sims-ISWS)
W79-09096

CASES OF MASS MORTALITY OF THE WALLEYE POLLOCK, THERAGRA CHALCOGRAMMA, IN THE SEA OF OKHOTSK,
Pacific Research Inst. for Fisheries and Oceanography, Magadan (USSR). Magadan Dept.
V. A. Vyshegorodtsev.
Journal of Ichthyology, Vol. 18, No. 1, p 146-147, 1978.

Descriptors: *Fish kill, *Mortality, *Fish disease, *Water temperature, Commercial fish, On-site-investigations, Parasitism, Pacific Ocean, Sea of Okhotsk, Kamchatka, *Walleye pollock, Mass mortality, Fish populations.

Mass mortalities of walleye pollock were observed in the spring of 1974 in the Northwestern part of the Sea of Okhotsk. The number of dead fish was no less than 2,780,000. Other mass mortalities of the same fish have been reported in March 1941 and 1958 off the Southwest Coast of Kamchatka. It is believed that epizootic disease in combination with the thermal regime in the area of fish concentration is the direct cause of the mass mortalities. (Katz-EIS)
W79-09098

TCDD IN THE ENVIRONMENT,
Power Authority of the State of New York.
For primary bibliographic entry see Field 5C.
W79-09101

CHLORINE IN THE MARINE ENVIRONMENT,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 5C.
W79-09102

ARSENIC AND OTHER TRACE ELEMENTS IN THE WATERS AND ORGANISMS OF AN ESTUARY IN SW ENGLAND,
Westfield Coll., London (England).
For primary bibliographic entry see Field 5A.
W79-09103

METAL ACCUMULATION BY AQUATIC BRYOPHYTES FROM POLLUTED MINE STREAMS,
Westfield Coll., London (England).
For primary bibliographic entry see Field 5A.
W79-09104

SEASONAL LEVELS OF CHLORINATED HYDROCARBONS AND HEAVY METALS IN FISH AND BROWN SHRIMPS FROM THE MEDWAY ESTUARY, KENT,
City of London Polytechnic (England). Dept. of Biological Sciences.
W. L. F. van den Broek.
Environmental Pollution, Vol. 19, p 21-38, 1979. 1 fig, 4 tab, 33 ref.

Descriptors: *Whiting, *Flounder, *Eels, *Polychlorinated biphenyls, *Path of pollutants, *Chlorinated hydrocarbon pesticides, *Mercury, *Cadmium, *Pesticide residues, Estuaries, Estuarine environment, Copper, Lead, Zinc, Heavy metals, Metals, Pesticides, Public health, Seasonal, Brown shrimp, Baseline studies, Medway Estuary(Great Britain), Industrial wastes, Agricultural runoff.

Selected fish, including eel, whiting, flounder, plaice, and some of their dietary constituents were screened for organochlorine pesticides (dieldrin, DDE, DDT, TDE), polychlorinated biphenyls and mercury, cadmium, copper, lead and zinc. Metal concentrations were low and indicated little more than background levels. Chlorinated hydrocarbons, on the other hand, tended toward the maximum part of the range of values quoted in the literature. They exhibited no marked seasonal variations which may have been connected with agricultural activities but their concentrations were correlated with the lipid content of most tissues. (Katz-EIS)
W79-09105

BIOACCUMULATION OF AROCLOR 1016 IN HUDSON RIVER FISH,
New York State Dept. of Environmental Conservation, Rome.
J. C. Skea, H. A. Simonin, H. J. Dean, J. R.

Colquhoun, and J. J. Spagnoli.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 332-336, 1979. 1 tab, 7 ref.

Descriptors: *Polychlorinated biphenyls, *Fish physiology, *Hudson River, *Aroclors, *Bioaccumulation, *Tissue analysis, Perches, Bullheads, Sunfishes, Path of pollutants, Chemical analysis, Water chemistry, Gas chromatography, On-site-investigations.

Brown bullheads (Ictalurus nebulosus), yellow perch (Perca flavescens), pumpkinseeds (Lepomis gibbosus) and creek chubsuckers (Erimyzon oblongus) were captured in a relatively uncontaminated lake and transferred to three cages in the Hudson River (New York). One cage was placed downstream from a suspected source of the PCB Aroclor 1016 while the other two were located upstream to serve as controls. After 14 days the fish were sacrificed and analyzed for PCB content. Analysis of fish from upstream cages and fish frozen for background levels showed residues of less than 0.02 micrograms/g Aroclor 1016 (lowest detectable level). Fish taken from the cage at the PCB site had Aroclor 1016 levels which varied from 1.8 micrograms/g in yellow perch to 3.8 micrograms/g in a composite of brown bullheads. The chromatograms of the fish residues were identical to those of Aroclor 1016. Using a mean fish concentration of 2.6 micrograms/g (range 1.8 ug/g - 3.8 ug/g) these fish in 14 days bioaccumulated Aroclor 1016 at 15,000 times the water concentration (0.17 micrograms/l). If we use 0.10 micrograms/l as the water concentration the 14 day bioaccumulation factor is 26,000. (Deal-EIS)
W79-09106

IN VIVO RESPONSE OF ATPASES IN FEW TISSUES OF THE FISH MYSTUS VITTATUS (HAM.) TO THE SYNTHETIC DETERGENT SWACOFIX (R) E45 (ABS),
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, D. Mohan, A. K. Tyagi, and R. C. Dalela.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, p 327-331, 1979. 2 tab, 12 ref.

Descriptors: *Enzymes, *Toxicity, *Detergents, *Tissue analysis, *Mystus, Fish physiology, Animal metabolism, Sulfonates, Chemical wastes, Biochemistry, Inhibition, Mode of action, Chemical analysis, Chemical properties, Swacofix, Bioassay.

The response of the ATPase system in brain, gill, liver and kidney from Mystus vittatus to chronic exposure to different sublethal concentrations of Swascofix (R) E45 was determined in vivo. The inhibition patterns of all ATPases assayed at all concentrations was quite similar in all four tissue types and was concentration dependent. The highest inhibition was noted in brain, followed by gill, kidney and liver, respectively. (Deal-EIS)
W79-09107

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,
Provinciale Waterstaat van Gelderland Arnheim (Netherlands).
For primary bibliographic entry see Field 5A.
W79-09108

EGG SHELL CHARACTERISTICS OF GANNETS SULA BASSANA, SHAGS PHALACROCORAX ARISTOTELIS AND GREAT BLACK-BACKED GULLS LARUS MARINUS EXPOSED TO DDE AND OTHER ENVIRONMENTAL POLLUTANTS,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
A. S. Cooke.
Environmental Pollution, Vol. 19, p 47-65, 1979. 7 tab, 8 fig, 43 ref.

Descriptors: *Bird eggs, *Water birds, *Gulls, *DDE, *Path of pollutants, *Polychlorinated biphenyls, *Dieldrin, Birds, Gannets, Black-backed gulls, Shag, Sula, Phalacrocorax, Larus, Pesticide residues, Shell thickness, Water pollution effects, Metabolism, Inhibitors.

Structure, strength and chemical composition of egg shells of gannets (Sula bassana), shags (Phalacrocorax aristotelis), and great black-backed gulls (Larus marinus) have been studied in relation to egg residues of DDE. For each species, eggs that were highly contaminated with DDE tended to have thin shells. For the gannet, shell thinning was mainly due to loss of the vaterite cover. For the shag, cover loss was again considerable, but the true shell was also significantly reduced in thickness. Gull shells do not have a cover, and for the great black-backed gull most of the shell thinning was due to a reduced palisade layer. The different types of structural defect observed in the shells of these and other species could result from a single biochemical lesion such as enzyme inhibition in shell gland tissue. As the thickness of the shell decreased, so shell strength for the gannet and shag did not decrease as markedly as for the gull and other species. Partial loss of cover had little effect on strength compared with loss of true shell. Had the cover been entirely missing, however, strength would have been seriously affected. (D. Katz-EIS)
W79-09110

RECENT PROGRESS IN TECHNIQUES FOR MANAGING CONTAMINATED BOTTOM SEDIMENTS,
Japan Dredging and Reclamation Engineering Association, Tokyo.
For primary bibliographic entry see Field 5A.
W79-09117

ACCUMULATION OF METHYL MERCURY IN RED SEA BREAM (CHRYSOPHRYS MAJOR) VIA THE FOOD CHAIN,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
For primary bibliographic entry see Field 5A.
W79-09119

THE RELATIONSHIP BETWEEN SEDIMENTS AND BENTHOS IN MIKAWA BAY,
Japan Dredging and Reclamation Engineering Association, Tokyo.
T. Otsuki.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the third U.S.-Japan Experts' Meeting--November 1977, Easton Maryland. Report No. EPA-600/3-78-084, p 95-119, 1978. 6 fig, 8 tab, 5 ref.

Descriptors: *Bottom sediments, *Benthic fauna, *Mathematical studies, *Bays, *Japan, Sediments, Water quality, Biological communities, Sampling, Chemical analysis, Chemical oxygen demand, Sulfides, Humic acids, Dominant organisms, Distribution patterns, Mollusks, Crustaceans, Mikawa Bay.

In this study an attempt has been made to clarify the relationship between the sediments and the benthos in Mikawa Bay. The calculation of the Sediment Pollution Index (SPI) and its significance are presented. A correlation analysis is made between factors of sediment quality and SPI on one hand and factors such as predominant benthic species on the other. The results obtained in this study have indicated that, to a certain extent, there are correlations between some items of the first group and some items of the second group, e.g., correlations have been observed between SPI and species number with a linear regression formula of $y = -0.775x + 25.301$ ($r = -0.765$), and between SPI and percent crustacea with $y = -0.903x + 22.292$ ($r = -0.715$). (See also W79-09113) (Deal-EIS)
W79-09120

A HYDRODYNAMIC STUDY OF LAKE POLLUTION,
Japan Bottom Sediments Management Association, Tokyo.
T. Yoshida.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton Maryland. Report No. EPA-600/3-78-084, p 121-145, 1978. 13 fig, 4 tab.

Descriptors: *Mathematical models, *Lakes, *Lake sediments, *Japan, Heavy metals, Zinc, Copper, Iron, Manganese, Water chemistry, Water quality, Water analysis, Biochemical oxygen demand, Path of pollutants, Suspended solids, Chemical oxygen demand, Lake stages, Runoff, Methodology.

To understand pollution of lakes by solid materials it was necessary to understand the hydrodynamic behavior of the solid pollutants. To achieve this end theoretical equations were deduced. The first result derived from these equations was the concept of the dilution ability of a lake. This was illustrated with examples of three lakes. Next, the theoretical estimation of the deposited quantities of solid pollutants was described, and the relationships between the accumulated quantities of pollutants and common pollution indices for sediment was discussed. Finally, the hydrodynamic equations were applied to the distribution of toxic heavy metals in lake sediments. From the results it may be concluded that hydrodynamic analysis of lake pollution is a useful tool. (See also W79-09113) (Deal-EIS)
W79-09121

MITIGATION FEASIBILITY FOR THE KEPONE-CONTAMINATED JAMES RIVER, VIRGINIA,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
K. M. Mackenthun, M. W. Brossman, J. A. Kohler, and C. R. Terrell.
In: Management of Bottom Sediments Containing Toxic Substances; Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 153-181, 1978. 8 fig, 5 tab, 20 ref.

Descriptors: *Persistence, *Pesticide residues, *Rivers, *Kepone, *James River(Virginia), *Mitigation, Chesapeake Bay, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Hazards, Chemical wastes, Public health, Chemical analysis, Chemical properties, Human pathology, Pesticide toxicity, Sediments, Dredging.

As the result of carelessness in production and in waste disposal the health of Kepone production workers at Hopewell, Virginia, has been jeopardized and a 70-mile reach of the James River has been contaminated by this hazardous and persistent pesticide. In addition, Chesapeake Bay is threatened. EPA's Kepone Mitigation Feasibility Project was undertaken to address the threat posed by Kepone contamination and to recommend possible cleanup action. The project involves: (1) assessment of the biological and ecological impact of Kepone through literature search, laboratory and field studies; (2) assessment of the potential sources of continuing contamination by inflows into the James River; (3) sampling and evaluation of the contamination in the James River; (4) modeling the movement of contaminants; and (5) evaluation of potential conventional and nonconventional methods for mitigating the problem. Preliminary results indicate that continuing inflows of contamination into the James River exist, and that there is no evidence of any degradation in the pesticide or indication that natural causes will substantially alleviate the problem in the foreseeable future. While some mitigation methods now look promising, their cost-effectiveness must be evaluated. (See also W79-09113) (Deal-EIS)
W79-09123

HUDSON RIVER - PCB STUDY DESCRIPTION AND DETAILED WORK PLAN,
New York State Dept. of Environmental Conservation, Albany.
E. G. Horn, and L. J. Hetling.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 183-198, 1978. 5 fig, 3 tab, 13 ref.

Descriptors: *Polychlorinated biphenyls, *Hudson River, *Monitoring, *Bioaccumulation, Law en-

forcement, Water quality control, Water quality standards, Hazards, Path of pollutants, Chemical wastes, Industrial wastes, Absorption, Bottom sediments, Dredging, Water chemistry.

In 1976 the New York State Department of Environmental Conservation and the General Electric Company signed an agreement bringing to a close an action brought against General Electric relating to the discharge of PCBs into the Hudson River. Part of the settlement involved setting up programs for monitoring and reclamation of the river. The program includes monitoring of fish, macroinvertebrates, sediment, hydrology, wastewater treatment plant input, water and air. Extensive study of the data acquired will be used to determine the feasibility of reclamation. (See also W79-09113) (Deal-EIS)
W79-09124

IMPACTS ASSOCIATED WITH THE DISCHARGE OF DREDGED MATERIAL INTO OPEN WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 5A.
W79-09126

EUTROPHICATION CONTROL: IMPORTANCE OF INTERNAL PHOSPHORUS SUPPLIES,
Corvallis Environmental Research Lab., OR.
D. P. Larsen, and D. W. Shults.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 239-261, 1978. 4 fig, 10 tab, 46 ref.

Descriptors: *Eutrophication, *Phosphorus, *Lakes, Nutrients, Chemical analysis, Sediments, Lake sediments, Bottom sediments, Sediment-water interfaces, Lake morphometry, Littoral, Turbidity, Aquatic populations.

Simple phosphorus mass balance models describing the relationship between supplies of phosphorus to lakes and resultant lake phosphorus concentrations demonstrate that internal supplies of phosphorus could be imporiant in controlling lake concentrations. Recent investigations show that several areas within lakes could supply significant amounts of phosphorus over short periods of time. These include sediments overlain by anaerobic water, macrophyte communities, and littoral zone sediments especially when stirred by wind-induced turbulence. Chemical analysis of the phosphorus content of surficial sediments shows that the sediments act as a significant phosphorus reservoir, but not all the sediment phosphorus is in a form readily exchangeable with overlying waters. Examples describing the importance of internal phosphorus supplies show that the restoration of some lakes has been delayed by the feedback of phosphorus from the sediments at critical times during the year. (See also W79-09113) (Deal-EIS)
W79-09128

THE REGULATION GUIDELINES AND CRITERIA FOR THE DISCHARGE OF DREDGED MATERIAL: PREDICTION OF POLLUTION POTENTIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
R. M. Engler.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 263-272, 1978. 2 fig, 2 tab, 3 ref.

Descriptors: *Dredging, *Waste disposal, *Regulation, *Bioaccumulation, Water quality control, Water quality standards, Bioassay, Benthic fauna, Sediments, Bottom sediments, Water chemistry, Chemical analysis, Suspended solids, Aquatic populations.

Guidelines and criteria have been published for the ecological evaluations of the discharge of dredged and fill material into inland waters and the transportation of dredged material for dumping into ocean waters. Implementation manuals have subsequently been published and are discussed herein. Relevant dredged material research are also presented. These manuals present evaluative procedures for pollution evaluation. (See also W79-09113) (Deal-EIS)
W79-09129

EVALUATION OF THE CHLOROPHYLL CONCENTRATION TO PREDICT THE TROPHIC STATE OF LAKES,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 225-228, June 1979. 9 ref.

Descriptors: *Chlorophyll, *Phosphorus, *Lakes, *Model studies, Mathematical models, Trophic level, Eutrophication, Nutrients, Phytoplankton, Forecasting, Water pollution, Limnology, Equations.

This paper presented a model for the relationship between the concentration of chlorophyll a and the total phosphorus concentration in a lake. From this model it is possible to predict the trophic state from the changing phosphorus content. (Sims-ISWS)
W79-09142

CHESAPEAKE BAY FUTURE CONDITIONS REPORT, VOLUME VI, APPENDIX 7, WATER QUALITY.
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 5A.
W79-09146

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,
Provinciale Waterstaat van Gelderland, Arnhem (Netherlands).
B. de Boer.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 199-211, June 1979. 8 fig, 14 ref.

Descriptors: *Dissolved oxygen, *Phytoplankton, *Rivers, *Model studies, Mathematical models, Biochemical oxygen demand, Aeration, Nutrients, Oxygen, Dispersion, Algae, Bacteria, Sewage, Sewage effluents, Pollutants, Path of pollutants, Water pollution, *The Netherlands.

The model presented has the purpose of predicting the effects of water resources management measures like sewage treatment, land fertilizer reduction, and water level control on the oxygen and phytoplankton dynamics in a stream. A dynamic, one-dimensional model of the behavior of BOD, a plant nutrient, phytoplankton, and oxygen was given. The processes described were local discharges like the effluent from sewage treatment plants, distributed discharges, extractions, advection, dispersion, photosynthesis and respiration by phytoplankton, respiration of bacteria (BOD-decay), use and return of nutrients, distributed reaeration and reaeration at weirs. A method of characteristics (nodes moving with the stream velocity) was chosen to prevent numerical dispersion in a flexible way, i.e., the dispersion coefficient and the stream velocity may vary with place and time, and are limited by the place and time step values acceptable, like the other inputs. Thus, realistic modelling is possible without the large computing times required by steady grid methods if the dispersion is low. This situation occurs frequently in The Netherlands. An application was shown. (Sims-ISWS)
W79-09157

ESTIMATION OF THE LONGITUDINAL DISPERSION AND SORPTION COEFFICIENTS IN SATURATED SOILS BY STRAIGHT-LINE METHODS,
Deutsche Akademie der Wissenschaften zu Berlin (German D.R.).
L. Luckner, and H. Reissig.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 229-238, June 1979. 7 fig, 5 tab, 3 ref.

Descriptors: *Path of pollutants, *Dispersion, *Sorption, *Model studies, Mathematical models, Laboratory tests, Soil water, Soils, Soil water movement, Soil contamination, Solutes, Migration, Saturated flow, Water pollution, Soil science.

This paper described a graphical method for the estimation of the longitudinal dispersion and sorption coefficients K sub L and alpha of the unidirectional migration processes of pollutants in saturated homogenous soils. The migration process was regarded (comparable to the classical pumping test analysis) not only as a process in space with t = t sub i = constant, but also as a temporal process with x = x sub i = constant. This method was demonstrated by several laboratory experiments with Cl(-) and Ca(2+) ions regarded as pollutants. It was also shown that the migration process calculated with K sub L and alpha estimated by this method corresponds excellently with the measured data. (Sims-ISWS)
W79-09158

ENVIRONMENTAL FATE OF SELECTED PHOSPHATE ESTERS,
Monsanto Co., St. Louis, MO.
V. W. Saeger, O. Hicks, R. G. Kaley, P. R. Michael, and J. P. Mieure.
Environmental Science and Technology, Vol. 13, No. 7, p 840-844, July 1979. 5 fig, 5 tab, 16 ref.

Descriptors: *Pollutants, *Path of pollutants, *Phosphorus compounds, *Biodegradation, Sampling, On-site investigations, Laboratory tests, Chemicals, Chemical analysis, Water pollution, Rivers, Phosphorus, Phosphates, Carbon dioxide, Solubility, Sludge, Activated sludge, Esters, Phosphate esters.

Environmental fate studies encompassing water solubility, octanol/water partition coefficient, and biodegradability were carried out for 11 trialkyl, alkyl aryl, and triaryl phosphate esters. These studies concluded that phosphate esters as a group exhibit low aqueous solubility, have a moderate potential for bioconcentration, and readily undergo primary and ultimate biodegradation by naturally occurring mixed-microbial populations present in activated sludge and river water. (Sims-ISWS)
W79-09162

PROBLEM ASSESSMENT REPORT: SOIL EROSION SUBCOMMITTEE--ILLINOIS AGRICULTURAL TASK FORCE ON NON-POINT SOURCES OF POLLUTION.
Illinois Inst. of Natural Resources, Springfield.
For primary bibliographic entry see Field 2J.
W79-09164

LEGAL PROBLEMS OF STORMWATER POLLUTION ABATEMENT,
Spessard L. Holland Law Center, Gainesville, FL.
For primary bibliographic entry see Field 6E.
W79-09184

NONPOINT SOURCE POLLUTION CONTROL STRATEGY,
Environmental Protection Agency, Washington, DC. Water Planning Div.
W. S. Groszyk.
In: Best Management Practices for Agriculture and Silviculture, Proceedings, 1978 Cornell Agricultural Waste Management Conference, p 3-10, 1979.

Descriptors: *Water pollution control, Water quality control, Federal water pollution control act, Water quality act, Water law, Management, *Nonpoint sources, *Farm practices.

This paper discussed the two major elements of the U.S. Environmental Protection Agency's nonpoint source (NPS) pollution control strategy, and how two amendments in the Clean Water Act of 1977 provide additional ways to implement NPS control

programs, and thus solve some of the critical water quality problems. These two major elements of EPA's nonpoint source control program were: (1) to accelerate the implementation of NPS control programs and the application of Best Management Practices (BMP's) and, (2) to focus the available resources on solving the most severe problems first. (See also W79-09185) (Skogerboe-Colorado State)
W79-09186

A STATE PERSPECTIVE ON NONPOINT SOURCE MANAGEMENT,
New York State Dept. of Environmental Conservation, Albany.
P. A. A. Berle.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 17-24, 1979.

Descriptors: Water pollution control, Water quality control, Water quality act, Soil conservation, Water conservation, Water management(Applied), State governments, *New York, *Nonpoint sources, *Farm practices.

This paper projects the governmental perspective of the New York state on nonpoint pollution control strategy. The concept of Best Management Practice (BMP) for non-point source control and management was endorsed. To prevent water pollution from rural nonpoint sources, it was felt necessary to develop BMP's tailored to meet New York's unique physical, economic and agricultural conditions; to identify serious nonpoint water quality problems for spatial priority attention; and to invite participation by every landowner in the existing cooperative soil and water conservation program. It was concluded that since technically nonpoint pollution control is a new and relatively unexplored area of concern, the initial BMP systems must be carefully designed to stay within the limits of current knowledge. (See also W79-09185) (Skogerboe-Colorado State)
W79-09188

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE: AN INTEGRATED OVERVIEW,
Environmental Research Lab., Athens, GA.
G. W. Bailey, and T. E. Waddell.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 33-56, 1979. 5 fig, 3 tab, 17 ref.

Descriptors: Water management(Applied), *Water pollution control, Water pollution sources, Legislation, *Social aspects, Economic feasibility, Institutional constraints, Forest management, *Farm practices, *Forest practices.

The evolution of agricultural and silvicultural practices was examined to place the environmental effectiveness of BMPs in perspective within today's control efforts. In addition, recent legislation was reviewed in terms of BMP identification, selection, and implementation approaches. The technical, social, and economic aspects of BMPs were examined by means of a systems approach. First, the physical system characterized by natural and man-made inputs, system properties (e.g., topography and soil) and outputs/pollutant loads (i.e., sediment, pesticides, plant nutrients, heavy metals, pathogens and easily oxidizable organics) were discussed. Second, this system was viewed as a partially controllable system within the context of a larger socio-economic setting driven by a multiplicity of exogenous forces. Socio-economic aspects of BMPs were discussed in terms of economic efficiency, social acceptability, equity, implementation incentives, and institutional arrangements. The paper identified and discussed a number of critical issues that demand attention. (See also W79-09185) (Skogerboe-Colorado State)
W79-09190

CONSERVATION DISTRICT INVOLVEMENT IN 208 NONPOINT SOURCE IMPLEMENTATION,
National Association of Conservation Districts, Washington, DC.
R. E. Williams, and J. E. Lake.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 57-67, 1979.

Descriptors: *Water pollution control, Water quality act, Water law, Legislation, Water management(Applied), Erosion control, Sediment control, Water pollution sources, Soil conservation, *Nonpoint sources, Farm practices.

A brief history of the establishment of conservation districts was presented including their authorities under the state laws enabling conservation districts organization. In addition, fifteen states have passed additional legislation providing districts with the authority to participate in special erosion and sediment control programs. Examples of how these programs are working in several of the states were discussed. The relationships of these and other programs with the new thrust toward implementing nonpoint water quality plans using the Best Management Practice approach was covered. Three case studies were presented where districts have demonstrated their abilities to be management agencies for implementing Best Management Practices. Finally, conservation districts' involvement in carrying out 208 nonpoint implementation as a result of recent legislation (ex: Culver amendment) was provided. Administrative, technical, and funding roles of state soil conservation agencies and conservation districts in implementing BMP's were stressed. (See also W79-09185) (Skogerboe-Colorado State)
W79-09191

ANIMAL MANURE MOVEMENT IN WINTER RUNOFF FOR DIFFERENT SURFACE CONDITIONS,
Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
D. B. Thompson, T. L. Loudon, and J. B. Gerrish.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 145-157, 1979. 1 fig, 4 tab, 16 ref.

Descriptors: *Agricultural runoff, *Nutrient removal, Runoff, Return flow, Water quality control, Chemical oxygen demand, Chemical degradation, Nonpoint sources, *Livestock wastes.

This experiment was designed to observe the impact of selected management practices on winter runoff quality. The effects of various surface conditions and buffer zones on runoff quality associated with land application of animal waste on frozen, snow-covered soil were evaluated. Three different surface covers with two lengths of buffer zone were compared as management practices which could be utilized for the reduction of nutrients contained in runoff from land application areas. The surface conditions used for the plots were corn stalk stubble with rows running across the slope, corn stalk stubble which had been fall disked across the slope, and established orchard grass. Runoff samples were analyzed for concentrations of ammonia, total Kjeldahl nitrogen, total phosphorus, chemical oxygen demand (COD), total and volatile solids. Twelve plots were established on a Hillsdale sandy loam soil with a 3.5% slope. The plots were 3 x 58 meters with the upslope 3 x 24 meters receiving the manure application. Four plots were used for each surface condition, two control and two spread with 62.7 M ton/ha of fresh dairy manure. The results of the experiment have been reported with discussion. (See also W79-09185) (Skogerboe-Colorado State)
W79-09197

ESTIMATION AND MANAGEMENT OF THE CONTRIBUTION BY MANURE FROM LIVESTOCK IN THE ONTARIO GREAT LAKES BASIN TO THE PHOSPHORUS LOADING OF THE GREAT LAKES,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
D. W. Draper, J. B. Robinson, and D. R. Coote.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 159-174, 1979. 2 fig, 4 tab, 39 ref.

Descriptors: *Agricultural runoff, Nutrient removal, Phosphorus, *Livestock wastes, *Great Lakes, Nonpoint sources, Feed lots.

As part of the work of the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG) a simple model has been developed for estimating contributions of total phosphorus to Great Lakes tributary loading originating with livestock manure produced in the Basin. Total loads attributable to livestock sources and a range of probable unit loads on a per animal unit per year basis were calculated. (See also W79-09185) (Skogerboe-Colorado State)
W79-09198

ESTIMATING PHOSPHORUS LOADING FROM LIVESTOCK WASTES: SOME WISCONSIN RESULTS,
Wisconsin Univ.-Madison. Water Resources Center.
I. C. Moore, F. W. Madison, and R. R. Schneider.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 175-192, 1979. 3 fig, 7 tab, 17 ref.

Descriptors: *Livestock wastes, Water pollution control, Water quality control, *Phosphorus, Agricultural watersheds, Pollutant identification, *Agricultural runoff, Analytical techniques, Nonpoint sources.

A description of an approach used to estimate phosphorus loading to the Great Lakes from livestock wastes in Wisconsin was presented. The results reported represent minimum annual loadings of total phosphorus to Lake Superior and Lake Michigan from areas of Wisconsin in these drainage basins. Estimates of the total phosphorus reaching surface waters from manure sources in the rest of the state were made on a per animal unit basis. The analytical techniques employed were reported separately. The emphasis was placed on the data requirements of the analysis. A key assumption of the methodology is that phosphorus in surface runoff will be linearly attenuated as long as the overland flow remains unchannelized. Thus, data on the location of barnlots and manure-spread fields with relation to surface features capable of channelizing flow were considered to be of primary importance. Problems encountered in determining this distribution of animal concentrations with respect to channels over a large and physiographically diverse region were discussed. (See also W79-09185) (Skogerboe-Colorado State)
W79-09199

PHOSPHORUS--A POTENTIAL NONPOINT SOURCE POLLUTION PROBLEM IN THE LAND AREAS RECEIVING LONG-TERM APPLICATION OF WASTES,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
K. R. Reddy, R. Khaleel, and P. W. Westerman.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 193-211, 1979. 7 fig, 7 tab, 29 ref.

Descriptors: *Phosphorus, Water quality, Runoff, Water pollution sources, Nutrients, *Livestock wastes, Nonpoint sources.

The main objective was to describe the P behavior in the soils treated with wastes and their relationship to the surface water quality. The results obtained from these studies indicated that application of animal wastes decreased P sorption capacity of the soil and increased P concentration in the soil solution, thus increasing the equilibrium P concentration (EPC), at which no net adsorption or desorption takes place. A significant relationship was observed between EPC values and P extracted with dilute acid (0.05 N HCl + 0.025 N H_2SO_4). Continuous application of wastes with high load-

ing rates of P resulted in P movement into deeper layers. Transport of P either into deeper soil layers or in the surface runoff water was dependent on the availability of soluble P in the soil surface at the time of rainfall event. Simple equations were developed to describe the availability of P at the soil surface, and the processes controlling P availability were also taken into consideration. (See also W79-09185) (Skogerboe-Colorado State)
W79-09200

NUTRIENT AND PESTICIDE MOVEMENT FROM FIELD TO STREAM: A FIELD STUDY,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. L. Baker, H. P. Johnson, M. A. Borcherding, and W. R. Payne.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 213-245, 1979. 10 fig, 7 tab, 21 ref.

Descriptors: *Nutrient removal, *Pesticide removal, *Agricultural runoff, Hydrologic aspects, Nitrogen, Phosphorus, Mathematical models, Sedimentation, Nonpoint sources.

The general objective is to provide a better understanding of the relationships between management farm systems and stream water quality and to enable analysis of such systems using mathematical models. Specific objectives are (1) to collect data to refine an Agricultural Runoff Model proposed by U.S. Environmental Protection Agency; (2) to relate runoff and soil-erosion nutrient (nitrogen and phosphorus) losses to hydrologic factors as altered by land management; (3) to relate losses of pesticides in runoff to pesticide properties and to hydrologic and management factors; and (4) to relate sedimentation to hydrologic and management factors. The study was described and initial results were presented. (See also W79-09185) (Skogerboe-Colorado State)
W79-09201

THE FATE OF NITRATE IN SMALL STREAMS AND ITS MANAGEMENT IMPLICATIONS,
Guelph Univ., (Ontario). Dept. of Environmental Biology.
J. B. Robinson, H. R. Whiteley, W. Stammers, N. K. Kaushik, and P. Sain.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 247-259, 1979. 6 fig, 2 tab, 20 ref.

Descriptors: *Nitrates, Nitrogen, Nitrogen cycle, Streams, Laboratory tests, Management, Denitrification, Nutrient removal.

The present paper is a continuation of earlier investigations conducted by the authors on nitrogen transformations in stream-sediment-water systems. This paper provides further evidence for significant amounts of nitrogen loss during transport in streams and indicates the stream management options which should enhance the process. (See also W79-09185) (Skogerboe-Colorado State)
W79-09202

AN APPROACH TO WATER RESOURCES EVALUATION OF NONPOINT SOURCES FROM SILVICULTURAL ACTIVITIES--A PROCEDURAL HANDBOOK,
Science and Education Administration, Fort Collins, CO.
J. B. Currier, L. E. Siverts, and R. C. Maloney.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 271-280, 1979. 1 fig, 1 ref.

Descriptors: Water pollution control, Water pollution sources, *Forest watersheds, Forest management, Soil erosion, Streamflow, Sediment discharge, Dissolved oxygen, Methodology, *Nonpoint sources, *Forest practices.

This handbook provided an analysis methodology that can be used to describe and evaluate the changes to the water resource due to nonpoint sources from silvicultural activities. It covered only the pollutant generation and transport processes and did not consider the economic, social and political aspects of pollution control. It provided quantitative techniques for estimating potential changes in streamflow, surface erosion, mass wasting, total potential sediment discharge, and temperature. Qualitative discussions of the impacts of silvicultural activities on dissolved oxygen, organic matter, nutrients, and introduced chemicals were also included. A control section provided a list of demonstrated effective control practices and a methodology to be used to select mixtures of these controls for the prevention and mitigation of water resource impacts. Such mixtures are the technical basis for formulating 'Best Management Practices' (BMP's). Because economic, social, and political analyses were not discussed in this chapter, the resulting mixtures of controls are not BMP's. (See also W79-09185) (Skogerboe-Colorado State)
W79-09204

NONPOINT SOURCE POLLUTION FROM AGRICULTURE: SOME SOCIOLOGICAL CONSIDERATIONS FOR IMPLEMENTING POLICY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
J. C. van Es, and L. C. Keasler.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 311-319, 1979. 1 fig, 8 ref.

Descriptors: Water pollution control, Social aspects, Social participation, Water quality control, Water policy, Water management(Applied), *Nonpoint sources, *Agricultural runoff.

Most of the discussion on NPS pollution control deals with the economics and the technical aspects of the issue. In this paper the contributions sociological analysis can make to the administration and implementation of a NPS-pollution control program were demonstrated. The first theme developed dealt with the distinction between policy goals and the objectives of specific programs created to reach the policy goals. The second theme dealt with the issue of participation in programs. The paper discussed the experience in agriculture with voluntary and mandatory programs of change and the likely consequences of choosing programs with voluntary or mandatory participation strategies. It was concluded that the program administrators will be in a better position to administer programs if they understand the relationship of the program objectives to the policy goal and make program implementation compatible with the various programs objectives. (See also W79-09185) (Skogerboe-Colorado State)
W79-09207

SOCIAL COSTS AND EFFECTIVENESS OF ALTERNATIVE NONPOINT POLLUTION CONTROL PRACTICES,
Economics, Statistics, and Cooperative Service, Ames, IA.
K. F. Alt, J. A. Miranowski, and E. O. Heady.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 321-327, 1979. 1 tab, 11 ref.

Descriptors: Water pollution control, Water quality control, *Social aspects, Cost comparisons, Cost-benefit analysis, Alternative costs, Social impact, Environmental control, *Nonpoint sources.

A study was undertaken to estimate the magnitude of the farm production cost adjustments that would result from implementing specific environmental policies in an intensively cropped river basin of about 940,000 acres in East-Central Iowa. A linear programming model was used to simulate the crop growing and erosion management activities of the area. An exponential abatement cost function resulted for the total cost of reducing the sedimentation rate of a reservoir at the mouth of the watershed. Some of the pollution control policies considered in the study did not restrict the farmer's choice to that particular crop management system which was most effective from an engineering standpoint. It was concluded that the choice of future pollution control policies needs to be based on the costs changes incurred by farmers as well as the administration and surveillance costs incurred by the public agency which administers the pollution policy, and therefore, a truly optimal choice among alternative pollution control policies can only be made when the total of all public and private costs is weighed against the total of all benefits received. (See also W79-09185) (Skogerboe-Colorado State)
W79-09208

MANAGEMENT AND FINANCING OF AGRICULTURAL BMPS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 6E.
W79-09209

FARM-LEVEL ECONOMIC EVALUATION OF EROSION CONTROL AND REDUCED CHEMICAL USE IN IOWA,
Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 3F.
W79-09211

ECONOMIC IMPACTS OF POLICIES TO CONTROL EROSION AND SEDIMENTATION IN ILLINOIS AND OTHER CORN-BELT STATES,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 4D.
W79-09212

THE POLICY RELEVANCE OF ALTERNATIVE INSTITUTIONAL APPROACHES TO 208 PLANNING,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W79-09215

ECONOMIC, INSTITUTIONAL AND WATER QUALITY CONSIDERATIONS IN THE ANALYSIS OF SEDIMENT CONTROL ALTERNATIVES: A CASE STUDY,
Wisconsin Univ.-Madison. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4D.
W79-09216

INSTITUTIONAL AND TECHNICAL ASPECTS OF THE DEVELOPMENT OF AGRICULTURAL BMPS IN A FIVE-COUNTY RURAL/URBAN MICHIGAN REGION,
Williams and Works, Inc., Grand Rapids, MI.
J. P. Jones, and J. C. Sutherland.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 455-462, 1979. 2 fig.

Descriptors: *Runoff, *Soil erosion, Waste treatment, Management, Water pollution control, Water law, *Michigan, Nonpoint sources, *Farm practices.

This is a case history of the development of a management oriented Waste Treatment Plan under the provisions of Section 208 of Public Law 92-500. It emphasized the management organization at all levels--state, regional and local--for the implementation of best management practices to control nonpoint diffuse sources of water pollution. Major emphasis of the control and management effort was directed toward urban and rural runoff and sedimentation; agricultural pollution such as that from herbicides and pesticides; pollution from construction practices and lesser nonpoint sources of water pollution such as septic systems and sanitary landfills. (See also W79-09185) (Skogerboe-Colorado State)
W79-09217

THE EVALUATION OF BEST MANAGEMENT PRACTICES FOR THE REDUCTION OF DIFFUSE POLLUTANTS IN AN AGRICULTURAL WATERSHED,
Resource Management Associates, West Chester, PA.
T. H. Cahill, R. W. Pierson, Jr., and B. Cohen.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 465-490, 1979. 14 fig, 9 tab, 10 ref.

Descriptors: *Agricultural watersheds, Land management, Water quality, Water quality control, *Agricultural runoff, Eutrophication, Lake Erie, Model studies, Great Lakes, *Nonpoint sources, *Farm practices.

The Honey Creek Watershed (180 s.m.) in the Sandusky basin of north central Ohio has been the subject of research by several agencies and institutions during 1976 and 1977. The basin has served as a pilot study area for the development of agricultural land management practices to reduce phosphorus input to Lake Erie. A computerized land resource data base has been created to evaluate options. Current research centers on the calibration of the EPA Non-point Source Model (NPS) for the watershed, with model parameter evaluation for BMP sensitivity. Because of the size of the basin with respect to prior NPS model calibration studies, 14 subbasin simulations were produced using the data base. Routing sub-routines were developed, using wave velocity for hydrographs and particle velocity for chemographs. Recommendations were made for model parameter inputs, to reflect greater sensitivity for management analysis. (See also W79-09185) (Skogerboe-Colorado State)
W79-09218

SEDIMENT AND NUTRIENT CONTRIBUTIONS TO THE MAUMEE RIVER FROM AN AGRICULTURAL WATERSHED,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
D. W. Nelson, E. J. Monke, A. D. Bottcher, and L. E. Sommers.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 491-505, 1979. 1 fig, 9 tab, 8 ref.

Descriptors: *Sediment discharge, Sediment load, Nutrient removal, *Agricultural watersheds, *Agricultural runoff, Sediment transport, Water pollution sources, Indiana, *Nonpoint sources, Maumee River.

Total amounts of water, sediment, and nutrients discharged from two subwatersheds of the Black Creek study area (5000 ha) Allen County, Indiana, were determined during 1975 and 1976. Above average precipitation was experienced during 1975, whereas 1976 was unusually dry. From 400 to 3700 kg of sediment/ha/yr was lost from the subwatersheds; land slope being the dominant factor in soil loss during the wet year and land use being the primary factor in drier year. Most of the total P transported was sediment-bound P, whereas a substantial proportion to total N in discharge water was nitrate. A few large rainfall events contributed to the transport of a high proportion of sediment and sediment-bound nutrients; whereas snow melt runoff accounted for disproportionally high transport of soluble nutrients. Surface runoff was the major source of sediment, sediment-bound nutrients, ammonium N and soluble organic N and P transported from the subwatersheds. Significant proportions of nitrate N originated from tile drainage and interflow, particularly in the more intensely cultivated subwatershed. A substantial proportion of soluble inorganic P was derived from septic tank effluent in one subwatershed. The relationship between fertility practices in the subwatersheds and quality of water being discharged was discussed. It was concluded that the effects of agricultural nonpoint source pollution and point source pollution on water resources are sufficiently different that direct comparisons between them cannot be made. (See also W79-09185) (Skogerboe-Colorado State)
W79-09219

WATER QUALITY MODELING IN THE DELAWARE COASTAL PLAIN REGION,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
W. F. Ritter, and P. A. Jensen.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 507-524, 1979. 7 fig, 3 tab, 24 ref.

Descriptors: *Agricultural runoff, Model studies, Water quality, Nitrogen, Simulation analysis, Storm runoff, Nitrogen cycle, Coastal plains, *Delaware, *Nonpoint sources.

A study of nonpoint modeling and the effect nonpoint sources have on water quality was conducted for the Coastal Sussex County 208 Water Quality Program. The EPA Agricultural Runoff Model was used in conjunction with a one dimensional water quality model of eleven parameters (NH4-N, NO2-N, NO3-N, phytoplankton-N, benthic N, herbivore N, particulate organic N, dissolved organic N, ultimate BOD, dissolved oxygen and total coliform) to analyze the effects of land use changes on water quality. The ARM Model and water quality model were used in Indian River Bay, Little Assawoman Bay, Rehoboth Bay and the Broadkill River. The ARM Model gave satisfactory results for runoff simulation, but did not give satisfactory results for nitrogen and phosphorus nonpoint source loads. A simulation study indicated that there would be no major water quality effects resulting from 20 year projected increases in urban areas or other land use changes. (See also W79-09185) (Skogerboe-Colorado State)
W79-09220

ESTIMATION OF AGRICULTURAL NONPOINT LOADS TO THE WAKARUSA RIVER BASIN USING THE 'NONPOINT CALCULATOR',
Midwest Research Inst., Kansas City, MO.
M. J. Davis, and J. W. Nebgen.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 525-550, 1979. 1 fig, 14 tab, 2 ref.

Descriptors: Water pollution control, Land management, Programs, *Agricultural watersheds, Sediment load, Pollutants, Kansas, *Nonpoint sources, Wakarusa River(KA).

An analysis of the nonpoint pollution sources in the Wakarusa River basin in eastern Kansas was undertaken. The Wakarusa basin is primarily rural, with the principal nonpoint pollutant loads arising from agricultural land. Soil Conservation Service information was used to develop the 'nonpoint calculator', a computerized methodology for estimating nonpoint loads. This procedure was developed under the sponsorship of the U.S. Environmental Protection Agency. The nonpoint calculator considers a variety of sources; pervious areas (erosion-related pollutants), impervious areas (urban sources), feedlots, landfills, salinity from irrigation return flow, and acid mine drainage. For the Wakarusa River basin study, the nonpoint calculator was used only for pervious agricultural land. The presentation described how the nonpoint calculator operates, and the type of information needed for input. It was shown that analysis of the output from the nonpoint calculator can pinpoint areas which require the development of plans for load reduction, either to preserve water quality or to maintain the soil resource. (See also W79-09185) (Skogerboe-Colorado State)
W79-09221

APPROACH FOR ANALYZING AND MANAGING AGRICULTURAL NONPOINT SOURCES IN THE STATE OF MARYLAND,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
R. F. Schoenhofer, W. A. Knight, and C. V. Hancock.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 551-561, 1979. 2 fig, 9 ref.

Descriptors: Water pollution control, Water quality control, Water quality act, Water pollution sources, *Maryland, Management, Decision making, *Planning, Agricultural chemicals, *Nonpoint sources.

This paper covered the following topics: (1) A description of the State of Maryland, its 208 planning areas and agencies, and a brief history of nonpoint source control efforts before the onset of 208 planning, which was prompted by P.L. 92-500; (2) A description of the organizational structure of the agencies involved in 208 planning as it relates to agriculture; (3) A description of the philosophy and the benchmark decisions relating to the development of the agricultural nonpoint source management program; and (4) A description of an information management system developed by the 208 program in cooperation with the Soil Conservation Districts, and its application as a part of program development. (See also W79-09185) (Skogerboe-Colorado State)
W79-09222

DEVELOPMENT OF A '208 PLAN' FOR AGRICULTURAL NONPOINT POLLUTION SOURCES IN ILLINOIS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
D. H. Vanderholm, J. F. Frank, and A. G. Taylor.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 563-580, 1979.

Descriptors: Water pollution control, Water quality control, *Planning, Pollution abatement, Water pollution sources, Soil conservation, *Illinois, *Nonpoint sources, Farm practices.

In June 1976, a task force on Agricultural Non-Point Sources of Pollution was appointed to advise the Illinois Environmental Protection Agency in producing a comprehensive water pollution control plan. Task force membership included representatives from agriculture, state and federal agencies, universities, and environmental groups. The task force was divided into subcommittees to deal with the specific areas of pesticides, soil erosion, fertilizers, livestock waste, and forestry and fruit production. The problem assessment phase of the plan was completed in March of 1977 and the recommended Best Management Practices (BMPs) were completed in October, 1977. The last phase of the report deals with recommended implementation methods and was completed in March 1978. The objective of this paper was to report the approach used by the task force for assessment of the pollution problem from agricultural nonpoint sources, suggested BMPs, and implementation strategy as recommended by the task force for adoption in Illinois. (See also W79-09185) (Skogerboe-Colorado State)
W79-09223

EVALUATION OF CONTROLS FOR AGRICULTURAL NONPOINT SOURCE POLLUTION,
Meta Systems, Inc., Cambridge, MA.
J. J. Wineman, W. Walker, J. Kuhner, D. V. Smith, and P. Ginberg.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 599-624, 1979. 8 fig, 5 tab, 10 ref.

Descriptors: *Methodology, Assessments, Model studies, Alternative planning, Water pollution, Water quality control, Evaluation, *Nonpoint sources, *Agricultural runoff, Farm practices.

A proposed methodology for assessing the water quality and socioeconomic impacts of agricultural practices was described and tested in a case study based on corn belt farming in northeastern Indiana. The potential use of the methodology to evaluate agricultural nonpoint source pollution control policies and the effects of alternative futures was illustrated. The development of such a methodology for state level planning appeared feasible and to be of significant value for broad analyses of large

numbers of policy alternatives, including identification of Best Management Practces. However, the methodology was at a preliminary stage of development when this report was presented. (See also W79-09185) (Skogerboe-Colorado State)
W79-09225

MATHEMATICAL MODELING OF WATER QUALITY EFFECTS OF AGRICULTURAL BEST MANAGEMENT PRACTICES,
URS Co., Seattle, WA.
C. Tang.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 625-647, 1979. 6 fig, 5 tab, 5 ref.

Descriptors: Water quality control, Water pollution control, *Mathematical models, Agricultural runoff, Biochemical oxygen demand, Ammonia, Coliforms, *Nonpoint sources, *Farm practices.

A series of computer models were used in the SNOMET/King County (Washington State) 208 study to determine the water quality effects of the implementation of best management practices (BMPs) designed to reduce nonpoint pollutant runoff from agricultural activities. Simulated results showed that under existing land use conditions, the pollutant reductions for BOD, ammonia and fecal coliform loads in the study area after BMP application were about 70%, 85% and 75%, respectively. Under the simulation condition, a combination of 7 day - 10 year low flow regime and an annual summer storm, the results showed that the in-stream concentration of fecal coliforms after BMP application in the Upper Snohomish River, was greatly improved from a frequent violation to a satisfactory level with respect to the State Standards. The results of these simulations helped to guide in the selection of BMPs for the agricultural areas. (See also W79-09185) (Skogerboe-Colorado State)
W79-09226

METHODOLOGY FOR DETERMINING THE OPTIMAL MIX OF BMP'S AND AGRICULTURAL PRODUCTION MODIFICATIONS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 6A.
W79-09227

MODELING NUTRIENT EXPORT IN RAINFALL AND SNOWMELT RUNOFF,
Cornell Univ., Ithaca, NY.
D. A. Haith, and L. J. Tubbs.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 665-685, 1979. 3 fig, 11 tab, 22 ref, 19 equ.

Descriptors: Nutrient removal, *Agricultural watersheds, *Mathematical models, *Agricultural runoff, Model studies, *Snowmelt.

Several mathematical models are available for the prediction of nutrient losses from agricultural watersheds. Most models have complex structures, require large computer programs and data banks and must be calibrated using streamflow data. There are obvious advantages, at least for planning purposes, in simpler modelling approaches with modest data and computational requirements. One such approach, which was evaluated in this paper, is the estimation of runoff from each unit source area within a watershed, multiplication of these runoff estimates by appropriate nutrient concentrations and summing the resulting mass fluxes for all source areas in the watershed. The approach is roughly equivalent to a distributed watershed model in which all flows are instantaneously routed to the watershed outlet. Mass fluxes of dissolved nitrogen, dissolved phosphorus and total phosphorus from agricultural runoff were estimated for each storm during a period of 18 months in 1972-1974 for the Fall Creek Watershed in upstate New York. The nutrient flux estimates were compared with measured nutrient exports from the watershed determined from water quality samples. (See also W79-09185) (Skogerboe-Colorado State)
W79-09228

MODELING SOIL AND WATER CONSERVATION PRACTICES,
Hydrocomp, Inc., Palo Alto, CA.
D. C. Beyerlein, and A. S. Dinigian.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 687-713, 1979. 9 fig, 4 tab, 16 ref.

Descriptors: *Agricultural runoff, Water conservation, Soil conservation, *Model studies, Agricultural watersheds, Sediment discharge, Frequency analysis, *Watershed management, Nonpoint sources, Farm practices.

The U.S. Environmental Protection Agency's Agricultural Runoff Management (ARM) Model was used to study the effects of soil and water conservation practices (SWCP) on nonpoint pollution from agricultural lands. The base conditions were defined as conventional agricultural practices for the region. Model parameters were then changed to represent the effects of a particular SWCP. The three major SWCPs studied were terracing, contouring, and conservation tillage. Continuous simulations of three to ten years in length were made to quantify the effects of each of the SWCPs compared to the base conditions. Runoff, sediment loss, and pesticide and nutrient washoff in solution and on sediment for a SWCP were compared with the base condition results. Results were analyzed both by total monthly and yearly amounts and by frequency of occurrence. ARM Model results were displayed with a Calcomp plotter to give a visual representation of how and when runoff and pollutant amounts changed with different SWCPs. The simulation methodology, the selection and evaluation of model parameters for particular practices, and the evaluation of the results in terms of the effects of different SWCPs were discussed. Limitations of the model to represent certain agricultural practices were presented along with areas for future research. (See also W79-09185) (Skogerboe-Colorado State)
W79-09229

INTERACTIVE EFFECTS OF PESTICIDE PROPERTIES AND SELECTED CONSERVATION PRACTICES ON RUNOFF LOSSES: A SIMULATION STUDY,
Environmental Research Lab., Athens, GA. Technology Development and Applications Branch.
J. D. Dean, and L. A. Mulkey.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 715-734, 1979. 7 fig, 3 tab, 28 ref.

Descriptors: *Agricultural runoff, *Pesticide removal, Conservation, Simulation analysis, Agricultural chemicals, Management, Sediment discharge, Water pollution control.

The prohibitive cost of long-term collection of chemical runoff data from agricultural activities makes the use of models attractive in evaluating impacts of management practices. This paper described a general methodology for model implementation and cited a specific case to indicate the potential of simulation studies for characterizing runoff losses. To test the methodology, a study was made using two different conservation practices on opposite ends of the managerial spectrum, three different sorptive pesticide properties, ten gradually increasing pesticide half-lives, and three meteorological input sequences for a total of 180 simulation years. The U.S. Environmental Protection Agency's Agricultural Runoff Management Model (ARM) and data from the Southern Piedmont agricultural region were used in the investigation. Results showed the interactive effects of pesticidal properties, watershed hydrology, and conservation practices on runoff losses of the chemicals, in water and on sediment. (See also W79-09185) (Skogerboe-Colorado State)
W79-09230

OCCURRENCE AND DISTRIBUTION OF HUMAN BACTERIAL PATHOGENS IN VIRGINIA SURFACE WATERS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
S. L. Wendt, B. C. Parker, and J. O. Falkinham, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 136, Price codes: A04 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia, Polytechnic Institute and State University, Bulletin 118, July 1979, 68 p. 3 fig, 29 tab, 48 ref. OWRT B-098-VA(1).

Descriptors: Aerosols, Mycobacteria, Environmental biology, *Pathogenic bacteria, *Coliforms, Surface waters, Virginia, Rain water.

This study surveyed the year-round occurrence and distribution of coliforms, fecal coliforms, total bacteria, and atypical mycobacteria detected from fresh, brackish, and marine waters in Virginia. The study also sought to evaluate the effectiveness of sampling surface microlayer waters relative to standard sampling of subsurface waters for detecting human bacterial pathogens. Past research has demonstrated that bacteria can be transferred from water to air by adsorption on gas bubbles that rise from the subsurface to the microlayer, and then burst at the water/air interface. The bacteria thus are ejected into the atmosphere to be dispersed by winds to other sites. Although most previous investigations have concentrated on this phenomenon as it occurs in seawater, this research dealth with the transfer of bacteria from freshwater to air. Coliform and fecal coliform bacteria showed no correlation with numbers of mycobacteria and total bacteria. Coliform and fecal coliform numbers consistently remained within permissible standards, and the potential pathogen, Pseudomonas aeruginosa, was isolated only in low numbers. Mycobacteria biochemically identical to known human pathogens were found in aerosols, rainwater, surface waters, and microlayer waters, including waters associated with treated sewage effluent. The most significant finding of the investigation showed that appreciable numbers of potentially pathogenic mycobacteria can move from water to air as aerosols with size ranges capable of penetrating the alveoli of human lungs. This discovery supports the hypothesis that water-to-air transfer of atypical mycobacteria can be a significant pathway of human infection.
W79-09231

EAGLE LAKE POLLUTION CONTROL PROJECT: ASSESSMENT OF LAKE IMPROVEMENT,
Minnesota Univ., Morris. Div. of Science and Mathematics.
For primary bibliographic entry see Field 2H.
W79-09232

THE IMPACT OF URBANIZATION ON THE DISTRIBUTION OF HEAVY METALS IN BOTTOM SEDIMENTS OF THE SADDLE RIVER,
Rutgers--The State Univ., New Brunswick, NJ. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W79-09233

WATER POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09320

MODELLING THE WATER QUALITY IN NEVA BAY,
Akademiya Nauk SSSR, Moscow.
E. V. Eremenko, V. A. Barannik, N. I. Selyouk, Y. M. Plis, and L. I. Lavrinenko.
Hydrological Sciences Bulletin, Vol. 24, No. 2, p 249-258, June 1979. 9 fig, 4 ref.

Descriptors: *Water quality, *Bays, *Model studies, *Mathematical models, Rivers, Flood protection, Estuaries, Pollutants, Oxygen, Dissolved oxygen, Nitrogen, Ammonia, Nitrates, Nitrites.

Oil, Phenols, Phosphorus, Biochemical oxygen demand, Distribution patterns, Spatial distribution, *Neva River(USSR), *Neva Bay(USSR), *USSR.

To evaluate the effects or proposed flood protection structures at the mouth of the Neva River on the water quality in Neva Bay, a model was proposed which described the water quality processes in Neva Bay. The following indices were modelled: permanganate oxidation, ammonium nitrogen, nitrite nitrogen, nitrate nitrogen, oil products, phenols, dissolved oxygen, detergents, mineral phosphorus, and BOD. Field data were compared to the results obtained from the model, and predictions were made of the distribution of different parameters. (Sims-ISWS)
W79-09326

ENFORCEMENT OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 TO CONTROL NONPOINT SOURCE POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09330

5C. Effects Of Pollution

LETHAL AND SUBLETHAL EFFECTS OF CADMIUM ON FRESHWATER CRUSTACEANS,
Monash Univ., Clayton (Australia). Dept. of Zoology.
P. S. Lake, R. Swain, and B. Mills.
Australian Water Resources Council Technical Paper No. 37, 1979. 213 p, 24 fig, 60 tab, 364 ref. Australian Government Publishing Service, Canberra. 74/71.

Descriptors: *Cadmium, *Toxicity, *Water pollution effects, Water pollution sources, Crustaceans, Aquatic animals, Freshwater, Amphipoda, Invertebrates, Mortality, Shrimp, Environmental effects.

The current knowledge of cadmium as a toxic element for fish and aquatic invertebrates is detailed including the results of a study involving two freshwater species. Brief reviews of the general distribution of cadmium in the environment, the chemical properties and distribution of cadmium in the aquatic environment, and the action of cadmium as a human pollutant are given. The 96-hr LC50 for cadmium in a standard 'soft' water at 20C was determined for the amphipod Austrochiltonia australis and the decapod shrimp Paratya. Increases in the total ion, calcium, and magnesium concentrations of the test solutions affected acute toxicity in varying degrees; some did not markedly affect the toxicity and some decreased the toxicity to one or both species. Acute toxicity to Austrochiltonia increased with an increase in temperature. The molt stage most resistant to acute toxicity in Paratya was premolt. In amphipods concentrations of cadmium in the body at death increased with increasing concentrations of cadmium in the test solution. The 'lowest unsafe' chronic concentration of cadmium appeared to be 0.001 mg Cd/l. Low concentrations of cadmium inhibited somatic growth of amphipods, and caused a decrease in food consumption, fecal pellet production, and locomotory activity. (Schaefer-IPA)
W79-09082

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME I: DISCUSSION,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
For primary bibliographic entry see Field 5E.
W79-09085

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME II: DATA REPORT,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
For primary bibliographic entry see Field 5E.
W79-09086

TOXICITY OF PULP AND PAPER MILL EFFLUENT: A LITERATURE REVIEW,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5A.
W79-09097

CASES OF MASS MORTALITY OF THE WALLEYE POLLOCK, THERAGRA CHALCOGRAMMA, IN THE SEA OF OKHOTSK,
Pacific Research Inst. for Fisheries and Oceanography, Magadan (USSR). Magadan Dept.
For primary bibliographic entry see Field 5B.
W79-09098

THE EFFECT OF MERCURIC CHLORIDE ON SOME BIOCHEMICAL INDICATORS OF THE BRAIN, BLOOD AND LIVER OF THE 'CASPIAN ROACH', RUTILUS RUTILUS CASPICUS,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Makhachkala (USSR). Dagestanskii Div.
V. K. Dokholyan, and T. P. Akhmedova.
Journal of Ichthyology, Vol. 18, No. 1, p 167-169, 1978. 2 tab, 9 ref.

Descriptors: *Toxicity, *Bioassay, Mortality, *Mercury, Metals, Freshwater fish, Fish physiology, Animal physiology, *Biochemistry, Nitrogen compounds, Water pollution effects, Ammonia, Glutamic acid, Proteins, Brain proteins, Albumins, Globulins, Blood.

Substantial changes occur in the organism of fish kept in mercury solutions. In a solution of 100 micrograms/l the fish perished, lower concentrations (10 and 5 micrograms/l) did not result in death, but they caused considerable disruption of the metabolism. Thus in the fish brain a considerable increase was noted in the content of ammonia, glutamic acid and the amide groups of brain proteins, and a decrease in glutamine and gamma-amino-butyric acid, while the amount of nitrogen metabolites in the brain of the test fish depends on the concentration of the toxicant, the age of the fish and the length of exposure. A decrease is observed in the total amount of protein, blood and albumins and a corresponding increase in alpha and beta globulins. The amount of sugar in the blood and glycogen in the liver decreases. The data indicate that pollution of the aquatic environment by mercury compounds may lead to a number of physiological-biochemical changes which are reflected in different physiological performances of the organism and may, in the end, result in a decrease in the fish productivity. (Katz-EIS)
W79-09099

COLCHICINE-INDUCED POLYPLOIDY IN BROOK TROUT,
Rhode Island Univ., Kingston. Dept. of Animal Science.
L. T. Smith, and H. L. Lemoine.
The Progressive Fish Culturist, Vol. 41, No. 2, p 86-88, 1979. 4 fig, 1 tab, 6 ref.

Descriptors: Bioassay, Mortality, Toxicity, Laboratory tests, *Colchicine, *Polyploidy, *Sterility, Water pollution effects, Fresh water fish, Brook trout, Fish management, Aquiculture, Fish control agents, Fish physiology, Fish reproduction, *Fish sterilants.

Fertilized eggs of brook trout before the first cleavage were challenged with 0.01% colchicine solution. The water temperature was 12 degrees C. There was an 11.3% increase in mortality resulting from the colchicine treatment. Polyploid cels were observed in four of six fish. Observations will be made to see if fish were sterile. (Katz-EIS)
W79-09100

TCDD IN THE ENVIRONMENT,
Power Authority of the State of New York.
D. Wallace, L. A. Norris, and C. L. Hawkes.
Transactions of the American Fisheries Society, Vol. 108, p 103-109, 1979. 43 ref.

Descriptors: *Toxicity, Mortality, Bioassay, On-site-investigation, *Dioxin, *2,4,5-T, Herbicides, Rainbow trout, Laboratory tests, *TCDD, 2,3,7,8-tetrachloro dibenzo-p-dioxin, Sediments, Biological concentration, Agricultural chemicals, Agricultural runoff, Forest management.

D. Wallace indicates that Norris and Hawkes, in an earlier paper, underestimate the amount and the effects of TCDD (2,3,7,8-tetrachloro-dibenzo-p-dioxin) that are discharged into the aquatic environment. Rainbow trout are not believed to be a suitable experimental animal upon which to base estimates. Norris and Hawkes observed that the ecological disasters suggested by Hawkes have not been observed in over 30 years of use of 2,4,5-T in forestry and agriculture. (Katz-EIS)
W79-09101

CHLORINE IN THE MARINE ENVIRONMENT,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman.
Oceanus, Vol. 22, p 36-43, 1979. 5 fig, 2 tab, 7 ref.

Descriptors: *Chlorine, Chlorination, *Marine plankton, Phytoplankton, Zooplankton, *Toxicity, Bioassay, Mortality, Juvenile fish, Juvenile growth stages, Larvae, Larval growth stages, *Bromine, Water pollution effects, Water pollution sources.

There is concern with the halogenated organic compounds discharged into the aquatic environment. Little is known of the effects of these compounds on marine species. The chemistry of free chlorine in sea water is complex. Chlorine reacts with bromine in sea water. The chlorine is used in power plants to control fouling organisms. The residual chlorine is discharged into the marine environment. Bioassays have been conducted at the Woods Hole Oceanographic Institution to determine the response of typical plankton organisms to chlorine discharges. Larval planktons and small fish are extremely sensitive to chlorine. (Katz-EIS)
W79-09102

METAL ACCUMULATION BY AQUATIC BRYOPHYTES FROM POLLUTED MINE STREAMS,
Westfield Coll., London (England).
For primary bibliographic entry see Field 5A.
W79-09104

SEASONAL LEVELS OF CHLORINATED HYDROCARBONS AND HEAVY METALS IN FISH AND BROWN SHRIMPS FROM THE MEDWAY ESTUARY, KENT,
City of London Polytechnic (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W79-09105

BIOACCUMULATION OF AROCLOR 1016 IN HUDSON RIVER FISH,
New York State Dept. of Environmental Conservation, Rome.
For primary bibliographic entry see Field 5B.
W79-09106

IN VIVO RESPONSE OF ATPASES IN FEW TISSUES OF THE FISH MYSTUS VITTATUS (HAM.) TO THE SYNTHETIC DETERGENT SWACOFIX (R) E45 (ABS),
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
For primary bibliographic entry see Field 5B.
W79-09107

A MOVING CELL MODEL OF THE DISSOLVED OXYGEN AND PHYTOPLANKTON DYNAMICS IN RIVERS,

Provinciale Waterstaat van Gelderland Arnheim (Netherlands).
For primary bibliographic entry see Field 5A.
W79-09108

INFLUENCE OF STOCK DENSITY AND FOOD USED ON GROWTH OF CARP KEPT IN COOLING WATERS,
Instytut Akwakultury i Techniki Rybackiej, Szczecin (Poland).
For primary bibliographic entry see Field 5A.
W79-09109

EGG SHELL CHARACTERISTICS OF GANNETS SULA BASSANA, SHAGS PHALACROCORAX ARISTOTELIS AND GREAT BLACK-BACKED GULLS LARUS MARINUS EXPOSED TO DDE AND OTHER ENVIRONMENTAL POLLUTANTS,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
For primary bibliographic entry see Field 5B.
W79-09110

EFFECT OF WATER TEMPERATURE ON THE INFECTION OF RAINBOW TROUT SALMO GAIRDNERI RICHARDSON WITH INFECTIOUS HAEMATOPOIETIC NECROSIS VIRUS,
Oregon State Univ., Corvallis. Dept. of Microbiology.
F. M. Hetrick, J. L. Fryer, and M. D. Knittel.
Journal of Fish Disease, Vol. 2, p 253-257, 1979. 1 tab, 7 ref.

Descriptors: *Rainbow trout, *Fish diseases, *Water temperature, Aquiculture, Fish hatchery, Thermal water, Bioassay, Laboratory test, Viruses, Fish conservation, Fish establishment, Fish farming, Fish physiology, Fish kill, Fresh water fish, Infectious haematopoietic necrosis virus.

Laboratory experiments with rainbow trout at water temperatures of 3, 6, 9, 12, and 15 degrees C indicate that they can be infected with infectious haematopoietic necrosis virus over a wide range of water temperatures. The use of elevated water temperatures does not seem to be a practical method of controlling IHN outbreaks. (Katz-EIS)
W79-09111

THE EFFECT OF PH ON OXYGEN CONSUMPTION AND ACTIVITY IN THE BATHYPELAGIC MYSID GNATHOPHAUSIAINGENS,
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-09112

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES: PROCEEDINGS OF THE THIRD U.S.-JAPAN EXPERTS' MEETING--NOVEMBER 1977--EASTON, MARYLAND,
For primary bibliographic entry see Field 5A.
W79-09113

PRESENT AND FUTURE WATER POLLUTION CONTROL PROJECTS IN JAPANESE RIVERS AND LAKES,
Ministry of Construction, Tokyo (Japan). River Improvement Div.
A. Kato.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 31-47, 1978. 12 fig, 5 tab, 2 ref.

Descriptors: *Water quality control, *Rivers, *Lakes, *Japan, Dredging, Sediments, Mercury, Polychlorinated biphenyls, Water quality, Regulation, Water quality standards, Water chemistry, Spoil banks.

Water pollution of public rivers and lakes in Japan has a magnified impact because of the limited water resources of the country. To prevent further deterioration of water quality, many water pollution control projects are being conducted under direct control or as grant-in-aid projects of the Ministry of Construction. A brief history of river pollution control projects was presented. Current projects and future long-term plans aimed at the improvement of the river environment were outlined. (See also W79-09113) (Deal-EIS)
W79-09115

TURBIDITY GENERATED BY DREDGING PROJECTS,
Ministry of Transport, Kobe (Japan). Bureau of Ports and Harbors.
For primary bibliographic entry see Field 5A.
W79-09116

RECENT PROGRESS IN TECHNIQUES FOR MANAGING CONTAMINATED BOTTOM SEDIMENTS,
Japan Dredging and Reclamation Engineering Association, Tokyo.
For primary bibliographic entry see Field 5A.
W79-09117

DREDGING TOXIC SEDIMENTS IN YOKKAICHI PORT,
Yokkaichi Port Authority (Japan).
For primary bibliographic entry see Field 5A.
W79-09118

ACCUMULATION OF METHYL MERCURY IN RED SEA BREAM (CHRYSOPHRYS MAJOR) VIA THE FOOD CHAIN,
Tsukuba Univ. (Japan). Inst. of Community Medicine.
For primary bibliographic entry see Field 5A.
W79-09119

THE RELATIONSHIP BETWEEN SEDIMENTS AND BENTHOS IN MIKAWA BAY,
Japan Dredging and Reclamation Engineering Association, Tokyo.
For primary bibliographic entry see Field 5B.
W79-09120

A HYDRODYNAMIC STUDY OF LAKE POLLUTION,
Japan Bottom Sediments Management Association, Tokyo.
For primary bibliographic entry see Field 5B.
W79-09121

THE TOXIC SUBSTANCES CONTROL ACT (TSCA): HOW IT AFFECTS EPA FROM A RESEARCH AND ENFORCEMENT STANDPOINT,
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
E. I. Wallen.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland, Report No. EPA-600/3-78-084, p 147-152, 1978.

Descriptors: *Regulation, *Law enforcement, *Water quality standards, Water quality, Water quality control, Penalties(Legal), Polychlorinated biphenyls, Chemical analysis, Research priorities, Research and development.

The purpose of the law is primarily to gather health effects data and to make these data available to everyone--to citizens of the United States, to other countries, to any labor union member or to anyone who wishes to have the information. A second purpose of the Act is to gather new health effects information through the testing of toxic chemicals. A third objective is to control the chemical industry in the prevention of pollution. The law provides that research may be performed in any area necessary to support the purposes of the Act. This includes health effects research, epidemiological research, and discovery monitoring. In terms of enforcement, the EPA regional offices have substantial authority for inspection both within the normal court procedures and unexpectedly by entering a plant without a warrant. The law also bans the production of PCBs. (See also W79-09113) (Deal-EIS)
W79-09122

MITIGATION FEASIBILITY FOR THE KEPONE-CONTAMINATED JAMES RIVER, VIRGINIA,
Environmental Protection Agency, Washington, DC. Office of Water and Hazardous Materials.
For primary bibliographic entry see Field 5B.
W79-09123

HUDSON RIVER - PCB STUDY DESCRIPTION AND DETAILED WORK PLAN,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5B.
W79-09124

AN OVERVIEW OF BOTTOM SEDIMENT PROBLEMS IN SAGINAW RIVER AND BAY, MARINETTE-MENOMINEE HARBOR, AND WAUKEGAN HARBOR,
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5A.
W79-09125

IMPACTS ASSOCIATED WITH THE DISCHARGE OF DREDGED MATERIAL INTO OPEN WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 5A.
W79-09126

A BIOASSAY FOR THE TOXICITY OF SEDIMENT TO THE MARINE MACROBENTHOS,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5A.
W79-09127

EUTROPHICATION CONTROL: IMPORTANCE OF INTERNAL PHOSPHORUS SUPPLIES,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5B.
W79-09128

THE REGULATION GUIDELINES AND CRITERIA FOR THE DISCHARGE OF DREDGED MATERIAL: PREDICTION OF POLLUTION POTENTIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 5B.
W79-09129

NORTH BRANCH POTOMAC RIVER BASIN MINE DRAINAGE STUDY--PHASE I. BASELINE SURVEY.
Skelly and Loy, Harrisburg, PA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 531, Price codes: A13 in paper copy, A01 in microfiche. Final Technical Report, May 1977. 295 p, 56 fig, 37 tab, 118 ref.

Descriptors: *Acid mine water, *Coal mines, *Water quality, *Aquatic habitats, Mine drainage, Reclamation, Simulation analysis, River basins, Planning, Surveys, Surface mines, Underground mines.

This survey of the mine drainage and related water resources of the North Branch Potomac River Basin established the extent, magnitude, and effects of coal mine drainage pollution. Alternative abatement and reclamation solutions were considered. The study included an analysis of socioeconomic and environmental conditions as related to the mine drainage problem. (Adams-ISWS)

W79-09144

ENERGY AND ENVIRONMENTAL STRESS IN AQUATIC SYSTEMS, SELECTED PAPERS FROM A SYMPOSIUM HELD AT AUGUSTA, GEORGIA, NOVEMBER 2-4, 1977.
Available from the National Technical Information Service, Springfield, VA 22161 as CONF-771114, Price codes: A00 in paper copy, A01 in microfiche. CONF-771114. DOE Symposium Series; 48. Thorp, J. H., and Gibbons, J. W., (Eds.). 854 p, 1978, Department of Energy, Technical Information Center, Oak Ridge, Tennessee.

Descriptors: *Environmental effects, *Conferences, Publications, Aquatic systems, Energy, Powerplants, Stress.

The proceedings includes a total of 49 papers which were presented at the symposium and which are devoted to the areas of modeling stresses, natural stresses and environmental fluctuations, fossil-fuel stresses, heavy-metal stresses, thermal stresses, and multiple and synergistic stresses. Author and subject indexes are included. (See W79-09236 thru W79-09284) (Chilton-ORNL)
W79-09235

MODELING ENVIRONMENTAL STRESS,
Maryland Univ., Solomons. Center for Environmental and Estuarine Studies.
R. E. Ulanowicz.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 1-18, 1978, 62 ref.

Descriptors: *Environmental effects, *Stress, *Model studies, Ecosystems.

This paper includes a discussion of environmental stress and ecosystem response to stress. Two classes of models are identified local (a model in which there is no explicit mention of a critical deviation, change in dimensionality or switch in function) and far-field (models in which the prominence of at least one of these characteristics is identifiable). It is stated that most ecosystem models fall into a low-level linear response category which does not provide sufficient information about sudden structural changes or structure after transition. It was concluded that macroscopic analyses of stressed ecosystems offer possible alternatives to compartmental models. (See also W79-09235) (Chilton-ORNL)
W79-09236

FREQUENCY RESPONSE OF A MARINE ECOSYSTEM SUBJECTED TO TIME-VARYING INPUTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
R. L. Dwyer, S. W. Nixon, C. A. Oviatt, K. T. Perez, and T. J. Smayda.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 19-38, 1978. 7 fig, 26 ref.

Descriptors: *Environmental effects, *Frequency analysis, Ecosystems, Model studies, Bays, Microcosm studies, Frequency responses, Time-varying inputs.

Time series of solar radiation, water temperature, ammonia and phytoplankton abundance from bay samples taken over a 17-year period and time series of ammonia and chlorophyll a from a 6-month sewage-perturbation experiment were analyzed by spectral analysis. Spectra for environmental inputs to the bay ecosystem showed periodicities only at 1 cycle/year while the spectrum for phytoplankton abundance showed additional significant periodicities at 2 and 4 cycles/year. These higher frequency processes appear to be harmonics of the fundamental driving frequency of 1 cycle/year. The presence of significant oscillations in the phytoplankton data at frequencies not found in any of the major environmental inputs indicates the existence of a nonlinearity in the primary production of the ecosystem. It was pointed out that a major difficulty in applying cross-spectral methods to data from natural ecosystems is that natural inputs fluctuate only at a few frequencies. Coherence between natural-input time series and ecological responses will be significant only at these frequencies. (See also W79-09235) (Chilton-ORNL)
W79-09237

APPLYING SURVIVAL CURVES TO ASSESSMENT OF FISH LARVAL ENTRAINMENT IMPACT,
NUS Corp., Pittsburgh, PA. Ecological Sciences Div.
M. D. Dahlberg.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 39-48, 1978. 1 fig, 2 tab, 15 ref.

Descriptors: *Environmental effects, *Entrainment, Powerplants, Model studies, Mortality, Fish populations.

The potential effects of entrainment are generally assessed by translating entrained fish eggs and larvae to the potential number of adults they represent. These calculations are accomplished with complex models and a simplistic equivalent-adult method (Horst model). This paper examines problems encountered in applying the model and discusses alternative procedures. Accuracy of the model depends on the proper selection of methods for calculating larval losses, lifetime fecundity, and larva-to-adult survival. It is recommended that potential adult loss should be expressed as a possible range. The calculated adult losses can be compared with some reference for acceptability, such as year-to-year variation in population size. (See also W79-09235) (Chilton-ORNL)
W79-09238

A SIMPLE MODEL FOR ASSESSING THE POTENTIAL LOSS OF ADULT FISH RESULTING FROM ICHTHYOPLANKTON ENTRAINMENT,
Environmental Research and Technology, Inc., Concord, MA.
W. P. Saunders, Jr.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 49-61, 1978. 2 fig, 3 tab, 17 ref.

Descriptors: *Environmental effects, *Entrainment, *Model studies, Mortality, Fish populations.

A revised form of the equivalent-adults model (Horst model) introduces several new assumptions which must be considered in using the model: survival corresponds to an exponential model during all planktonic life stages; all mortality during the first year of life occurs during the planktonic life stages; vulnerability of plankton to entrainment remains constant throughout the planktonic stages; plankton that are the victims of natural mortality are not entrained; and survival from egg to adult is an approximate estimator of first-year survival. Analysis of these assumptions shows that the model will overestimate impact, but such overestimates are considered acceptable in using this model as a preliminary impact-assessment tool. (See also W79-09235) (Chilton-ORNL)
W79-09239

STRESS AND ECOSYSTEMS,
Florida Univ., Gainesville. Dept. of Botany.
A. E. Lugo.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 62-101, 1978, 8 fig, 5 tab, 114 ref.

Descriptors: *Environmental effects, *Stress, Ecosystems, Energy budget, Reviews.

The paper presents a literature review which defines stress and stressors and the effects of stress on ecosystems. Stressors with highly concentrated energy sources which divert low-quality energy flows are said to have greater impact on ecosystems than stressors with diluted energy sources which impact high-quality energy flows. It is suggested that the best way to arrange and analyze ecosystems hierarchically accord to their capacity to develop complexity and tolerate stress is to classify them by their energy budgets. Emphasis is placed upon the fact that ecosystem management requires that studies be done at the ecosystem level with care to quantify the stressor and the stress in units of comparable energy quality. (See also W79-09235) (Chilton-ORNL)
W79-09240

ECOSYSTEM RESPONSES TO STRESS IN AQUATIC MICROCOSMS,
Georgia Univ., Athens. Inst. of Ecology.
J. W. Leffler.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 102-119, 1978. 2 fig, 5 tab, 19 ref.

Descriptors: *Environmental effects, *Stress, Model studies, Ecosystems, Aquatic life, Microcosms, Microcosm studies, Stress response.

This paper attempts to clarify the stress concept and advocates an empirical approach which requires that strict operational definitions be developed to clarify theoretical concepts. Microcosms are proposed as living models of large natural ecosystems which are potentially valuable tools for developing and testing theories of ecosystem dynamics. The use of aquatic microcosms to evaluate the stabilizing effects of species diversity and nutrient availability is described. No relationship could be demonstrated between resistance and resilience of stressed microcosms or between their steady-state variability and any measure of their perturbed behavior, suggesting that some hypotheses which seek to describe an ecosystem's stress response are incorrect and require clarification. (See also W79-09235) (Chilton-ORNL)
W79-09241

PHYSICOCHEMICAL AND BIOLOGICAL STRESSORS AS DISTRIBUTIONAL DETERMINANTS OF CARIBBEAN AND TROPICAL EASTERN PACIFIC SWIMMING CRABS,
Iowa Univ., Iowa City. Dept. of Zoology.
E. A. Norse.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 120-140, 1978. 2 fig, 4 tab, 33 ref.

Descriptors: *Environmental effects, *Stress, Aquatic life, Distribution patterns, Crabs, Pacific Ocean, Caribbean Ocean, Resistance, Biological stress, Physicochemical stress, Stress response.

Data from field studies indicate that Euphylax robustus in the Pacific and Portunus, Arenaeus, and Cronius spp. in the Pacific and the Caribbean occur predominately farther offshore, deeper or in higher salinities than Callinectes spp. High-temperature and desiccation tolerance appear to be less important than hyposalinity tolerances in permitting Callinectes to penetrate estuaries and shallow areas. The possibility of dilution limits distributions as stress increases. Increased interference and exploitation competition, predation, parasitism, food quality and abundance and interactions of these factors limit seaward distribution. It was concluded that biological stress increases as physicochemical stress decreases. (See also W79-09235) (Chilton-ORNL)
W79-09242

EFFECTS OF FLUCTUATING FLOW RATES AND WATER LEVELS ON CHIRONOMIDS: DIRECT AND INDIRECT ALTERATIONS OF HABITAT STABILITY,
Oklahoma Univ., Norman. Dept. of Zoology.
A. P. Covich, W. D. Shepard, E. A. Bergey, and C. S. Carpenter.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-

771114. p 141-156, 1978. 7 fig, 1 tab, 36 ref.

Descriptors: *Environmental effects, *Flow, Flow rates, Water levels, Diptera, Populations, Aquatic life, Reservoir releases.

Macroinvertebrates were collected from 7 stations on the Grand River and two of its tributaries in Oklahoma. Of the 122 taxa collected, 24 were Chironomids dominated by Glyptotendipes. Studies showed that fluctuations in water level and water flow resulting from reservoir discharge influenced the chironomid populations in both the discharge-receiving river and its tributaries. The greater the degree of fluctuations, the greater the effects appeared to be. Decreasing density, biomass, and numbers of genera characterized the most intensely fluctuating sites. (See also W79-09235) (Chilton-ORNL)
W79-09243

ENVIRONMENTAL IMPLICATIONS OF COAL-CONVERSION TECHNOLOGIES: ORGANIC CONAMINANTS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. W. Gehrs.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 157-175, 1978. 5 fig, 2 tab, 39 ref. DOE W-7405-eng-26.

Descriptors: *Environmental effects, *Energy, *Coals, Organic compounds, Effluents, Chemistry, Coal conversion.

This paper describes coal-conversion technologies, identifies types of organic contaminants expected to be released, summarizes the literature on environmental effects and presents research strategy for addressing potential environmental effects. Two approaches are presented for studying the potential environmental impact of the hundreds, perhaps thousands, of individual compounds which may be present in aqueous effluents. These approaches involve testing the whole complex effluent or testing individual compounds. It was concluded that certain components from each of the two approaches must be used. Testing complex mixtures, coupled with chemical fractionation, allows for determination of acute toxicities and identification of active components in the effluent. Investigation of individual compounds becomes manageable by grouping of compounds on the basis of chemical structure. (See also W79-09235) (Chilton-ORNL)
W79-09244

THE STREAM ENVIRONMENT AND MACROINVERTEBRATE COMMUNITIES: CONTRASTING EFFECTS OF MINING IN COLORADO AND THE EASTERN UNITED STATES,
Colorado State Univ., Fort Collins.
J. V. Ward, S. P. Canton, and L. J. Gray.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. p 176-187, 1978. 3 fig, 3 tab, 16 ref. EPA R803950.

Descriptors: *Environmental effects, *Mining, Coal mines, Aquatic life, Colorado, Invertebrates, Water pollution, Mine wastes.

Species composition, diversity, and standing crop of macroinvertebrate communities in a Colorado stream were compared with these factors in streams in eastern states. The Colorado stream was generally characterized by low values of sulfate and iron, highly-buffered waters, and low levels of toxic substances. Moderate inputs of soluble salts increased macroinvertebrate abundance without significantly changing community structure or giving other indications of stressed conditions. Major problems were increased salinity, sedimentation, and water depletion. It was concluded that mining in the West may not have the severe impacts on stream biota which characterize many eastern mining regions. (See also W79-09235) (Chilton-ORNL)
W79-09245

MEIOFAUNAL ABUNDANCE IN SANDBARS OF ACID MINE POLLUTED, RECLAIMED, AND UNPOLLUTED STREAMS IN SOUTHEASTERN OHIO,
Ohio Univ., Athens. Dept. of Zoology.
W. D. Hummon, W. A. Evans, M. R. Hummon, F. G. Doherty, and R. H. Wainberg.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 188-203, 1978. 1 fig, 3 tab, 18 ref.

Descriptors: *Environmental effects, *Mining, Acid mine water, Wildlife, Aquatic life, Ohio, Water pollution, Streams, Sediments, Meiofauna, Abundance, Diversity.

Meiofaunal samples were collected at each of two sites along seven streams during a period of stable weather. Physical-chemical parameters measured at each of 14 sites included temperature, pH, conductivity, carbonate alkalinity, sulfates, calcium and total hardness, manganese, iron, dissolved oxygen, biochemical oxygen demand, and stream flow. The number of major taxa collected ranged from 3 to 11 with geometric mean abundance of total meiofauna/station ranging from 21 to 443 organisms/10 square cm of surface. Diptera, one of 16 taxa seen, total numbers of taxa present, and geometric means of total meiofauna were negatively correlated with values for compensated noncarbonate conductivity. Results of similarity analysis formed a pattern. Unpolluted streams along with several sites with a past history of mining showed H' diversity values of 1.6 to 2.8 with 40 to 80% in common. The remaining sites, all with a past history of mining, formed two groups. One group, dominated by rotifers, showed H' values of 1.2 to 1.6 with 36 to 52% in common while the other group, dominated by nematodes, showed H' values of 1.3 to 1.5 with 46% in common. (See also W79-09235) (Chilton-ORNL)
W79-09246

CYTOTOXICITY OF UNTREATED COAL-CONVERSION GASIFIER CONDENSATE,
Tennessee Univ., Oak Ridge. Graduate School of Biomedical Sciences.
T. W. Schultz, J. N. Dumont, and L. M. Kyte.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 204-218, 1978. 5 fig, 1 tab, 21 ref.

Descriptors: *Environmental effects, *Coals, Toxicity, Protozoa, Behavior, Respiration, Growth rates, Coal-conversion technology, Gasifier, Condensate, Cytology.

The behavior, respiration, cytology, and growth rates of Tetrahymena pyriformis exposed to varying concentrations of untreated laboratory-scale Synthane gasifier condensate were investigated. Little if any change in shape and motility were seen at concentrations of 1% but at 2% or greater decrease in motility and increase in cell lysis were observed. The condensate caused a nonlinear, dose-dependent reduction in oxygen consumption. At all concentrations there were cytological alterations in the mitochondrial matrixes, which became more electron dense. Cell membranes disrupted and mucocysts were discharged. Population growth was reduced by product water concentrations as low as 0.2% and completely inhibited at 1%. (See also W79-09235) (Chilton-ORNL)
W79-09247

AQUATIC TOXICOLOGY OF TRACE ELEMENTS OF COAL AND FLY ASH,
Thomas Hunt Morgan School of Biological Sciences, Lexington, KY.
W. J. Birge.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 219-240, 1978. 5 fig, 6 tab, 34 ref.

Descriptors: *Environmental effects, *Toxicology, *Trace elements, Coals, Fly ash, Aquatic life, Embryonic growth stage, Larval growth stage.

Aquatic bioassays were performed to establish a comparative toxicological ranking for 22 coal elements. Embryo-larval bioassays showed the high toxicity of many elements to aquatic biota. Depending on species, LC50 values of 0.1 ppm or less were found for 15 coal elements and calculated LC1's ranged down to 0.1 to 0.2 ppb for mercury and silver. Tungsten was the least toxic element. The increasing order of sensitivity of animal species was goldfish, trout, and toad. Order of toxicity of the elements varied somewhat for embryo-larval stages. Ag, Cd, Cr, Hg, Ni, and Pb were among the 12 most toxic for all three species and Al, As, Co, Cu, Ge, V, and Zn were included in the most toxic group for trout and goldfish. It was concluded that a substantial number of trace elements of coal and fly ash are highly toxic to aquatic organism. Many of these are leachable from ash residues at concentrations that prove lethal to fish and amphibian embryo-larval stages. (See also W79-09235) (Chilton-ORNL)
W79-09248

MERCURY CONTAMINATION STANDARDS FOR MARINE ENVIRONMENT,
Environmental Research Lab., Narragansett, RI.
R. Eisler.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 241-272, 1978. 2 tab, 296 ref.

Descriptors: *Environmental effects, *Mercury, Aquatic life, Water quality standards, Water pollution, Water quality, Standards.

This paper reviews the literature on mercury effects in saline waters and recommends criteria and research approaches for incorporating mercury contamination standards which would protect marine products of commerce, their food organisms and their predators. Specific recommendations include the prohibition of the sale, manufacture, and use of methyl mercury compounds; restriction of the use of other mercurials; development of alternative technologies; removal of mercury from contaminated waterways; development of monitoring criteria; refinement of chemical methods for the detection of mercury; and the application of recommendations to other contaminants. (See also W79-09235) (Chilton-ORNL)
W79-09249

A RADIOISOTOPIC STUDY OF MERCURY UPTAKE BY HUDSON RIVER BIOTA,
New York Univ. Medical Center, Tuxedo. A. J. Lanza Research Lab.
L. S. Zubarik, and J. M. O'Connor.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 273-289, 1978. 4 fig, 5 tab, 34 ref. NIEHS ES-00260.

Descriptors: *Environmental effects, *Path of pollutant, Mercury, Hudson River, Algae, Plankton, Absorption, Larvae, Temperature, Seasonal, Organic compounds.

A variety of Hudson River forage organisms, ranging from algae to fish larvae, accumulated mercury compounds from the test environment. Concentrations in organisms ranged from 100 to 1,000,000 times that in the test medium. Uptake occurred via food as well as directly from water. Greatest relative concentration occurred among algae and the least among larger planktonic crustacea and striped bass larvae. Experiments with Gammarus showed greater uptake of organic over inorganic forms of mercury but only after exposures of 1 week. Initial uptake of both forms was rapid. Uptake of all forms of mercury compounds increased during the summer months with increase of organic forms increasing to a greater extent than that of inorganic forms. Temperature change was found to be an important factor in the degree of uptake. (See also W79-09235) (Chilton-ORNL)
W79-09250

IMPACT OF ARSENICALS ON NITRIFICATION IN AQUEOUS SYSTEMS,

Southeast Environmental Research Lab., Athens, GA.
H. W. Holm, and M. F. Cox.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 290-300, 1978. 4 fig, 1 tab, 20 ref.

Descriptors: *Environmental effects, *Arsenic, *Nitrification, Bacteria, Nitrites, Ammonia.

The impact of arsenicals (at concentrations of 0, 0.1, 1, 10, 100, and 1000 mg As/l) on nitrification was determined by measuring the oxidation of ammonia and nitrite. At concentrations of 100 and 1000 mg As/1, arsenate decreased the rate of oxidation of ammonia by Nitrosomonas. Oxidation of nitrite to nitrate by Nitrobacter was delayed at concentrations of 0.1, 1, and 10 mg As/1 and concentrations of 100 and 1000 mg As/1 inhibited the process. At concentrations of 1000 mg As/1, the oxidation of ammonia by Nitrosomonas was delayed by cacodylic acid. Nitrobacter was not affected by cacodylic acid. (See also W79-09235) (Chilton-ORNN)
W79-09251

COPPER SENSITIVITY OF ADULT PACIFIC OYSTERS,
California Univ., Livermore. Lawrence Livermore Lab.
F. L. Harrison, and D. W. Rice, Jr.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 301-315, 1978. 2 fig, 3 tab, 34 ref. DOE W-7405-ENG-48 & NRC 60-76-144.

Descriptors: *Environmental effects, *Toxicity, Copper, Oysters, Absorption, Mortality.

Oysters were exposed to copper at concentrations ranging from 100 to 1300 microg/1 in a flow-through bioassay system. The family of mortality curves of time vs. copper concentration was difficult to interpret because increased copper concentrations did not consistently result in increased mortality rates. Correcting the duration of copper exposure by a factor related to the length of time that the shell was open produced more typical curves. At concentrations of 200 microg Cu/1 and higher, significant mortalities occurred. Data showed an LC50 at 48 hr of 650 microg/1, and LC50 at 96 hr of 430 microg/1, and an incipient LC50 of 230 microg/1. (See also W79-09235) (Chilton-ORNL)
W79-09252

AN IN SITU STUDY OF CADMIUM STRESS IN A NATURAL ZOOPLANKTON COMMUNITY,
Argonne National Lab., IL. Radiological and Environmental Research Div.
J. S. Marshall, and D. L. Mellinger.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 316-330, 1978. 2 fig, 3 tab, 38 ref.

Descriptors: *Environmental effects, Water pollution, Cadmium, Biological communities, Zooplankton, Toxicity.

Results of this study showed that added cadmium concentrations as low as 5 microg/1 caused significant effects on both functional and structural attributes of a Lake Michigan zooplankton community in 9 days but that the effects of enclosure were relatively minor up to 15 days. Significant differences in species' rates of increase were seen among Cladocera, Calanoida, and Cyclopoida but similar sensitivities were seen within each group. Results indicated that added cadmium concentrations less than 5 microg/1 probably would cause detectable effects within 9 days and that incubations up to 15 days are feasible. (See also W79-09235) (Chilton-ORNL)
W79-09253

THERMAL ECOLOGY AND STRESS: A CASE HISTORY FOR RED-SORE DISEASE IN LARGEMOUTH BASS,
Wake Forest Univ., Winston-Salem, NC. Dept. of Biology.
G. W. Esch, and T. C. Hazen.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 331-363, 1978. 18 fig, 1 tab, 40 ref.

Descriptors: *Environmental effects, *Stress, *Thermal stress, Fish diseases, Biological communities, Populations, Bass.

This paper describes the stress phenomenon in physiological terms and illustrates how it has application at the individual and ecosystem levels of organization. These relationships are represented by describing the case history of red-sore disease among largemouth bass in the southeastern U.S. Based on information of the distribution of largemouth bass and the bacterium which causes red-sore disease (Aeromonas hydrophila) and the fact that the disease has only been reported in the southeastern U.S., it was concluded that a unique assortment of physiochemical properties in a given aquatic system, an assemblage of susceptible hosts, and the presence of the bacterium would promote an epizootic outbreak of the disease. It is hypothesized that stress and its impact at individual, population, and ecosystem levels of organization would temper the potential for outbreak. (See also W79-09235) (Chilton-ORNL)
W79-09254

SIZE-FRACTIONATED PRIMARY PRODUCTIVITY IN LAKE MICHIGAN NEAR THE KEWAUNEE NUCLEAR POWER PLANT,
Wisconsin Univ.-Milwaukee. Dept. of Botany.
S. I. Zeeman, and R. Grunewald.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 364-380, 1978. 1 fig, 4 tab, 36 ref.

Descriptors: *Environmental effects, *Powerplants, Cooling water, Primary productivity, Phytoplankton, Lake Michigan, Kewaunee Nuclear Power Plant, Populations.

Samples were collected from a precondenser station and a postcondenser station on eighteen dates. Productivity was determined for three size fractions by filtration through 64-, 10-, and 0.45 microm porosity filters. In the unfractionated samples, univariate analysis of variance indicated that there was no difference between pre and post condenser productivity rates. Multivariate analysis of variance applied to size-fractionated samples indicated that there were lower productivity rates only when a temperature rise occurred across the condenser. Average productivity rates during the period of the study at the postcondenser station were within 13% of those at the precondenser station. Chlorophyll a values were within 4% of precondenser values. It was concluded that phytoplankton populations suffer no damage in passage through the cooling system even though individuals may be killed. (See also W79-09235) (Chilton-ORNL)
W79-09255

PRIMARY PRODUCTIVITY: ANALYSIS OF VARIANCE IN A THERMALLY ENRICHED AQUATIC SYSTEM,
Rice Univ., Houston, TX.
M. O. Welch, and C. H. Ward.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 381-391, 1978. 5 fig, 21 ref.

Descriptors: *Environmental effects, *Thermal stress, *Water pollution, Aquatic life, Phytoplankton, Cooling water, Reservoir, Primary productivity, Temperature.

In situ investigation of primary productivity of heated and ambient surface waters, and enrichment response was made in a cooling reservoir of a 530 MW electric generating plant. Analysis of variance techniques showed that primary productivity was significantly increased at the heated station on 18 of the 26 sampling days. The magnitude of this difference was not correlated with difference in water temperature at the stations. Nutrient enrichment did not appear to have an effect on primary productivity. Temperature optimum for the natural community of phytoplankton was determined to be approximately 25C. The phytoplankton community exposed to higher temperature exhibited a higher tolerance range than did the community at ambient temperature. (See also W79-09235) (Chilton-ORNL)
W79-09256

NITRATE REDUCTASE ACTIVITY AND PRIMARY PRODUCTIVITY OF PHYTOPLANKTON ENTRAINED THROUGH A NUCLEAR POWER STATION ON NORTHEASTERN LONG ISLAND SOUND,
Connecticut Coll., New London. Dept. of Botany.
B. B. Peck, and R. S. Warren.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 392-409, 1978. 5 fig, 2 tab, 25 ref.

Descriptors: *Environmental effects, *Powerplants, Temperature, Chlorine, Primary productivity, Phytoplankton, Long Island Sound, Cooling water, Nitrate reductase activity.

Samples taken at the cooling water intake of a nuclear power plant during August showed ambient temperatures ranging from 19.5 to 20 C. During power generation, water temperatures showed an increase of 11 and 14 C at the discharge. Phytoplanktonic nitrate reductase activity was depressed by 88 to 89% and primary productivity by 42 to 52% during the 6- to 9-hr transit through the cooling pond. Nitrate reductase activity in phytoplankton which had been exposed to mean temperature increases of 13 C on seven days in August did not return to normal intake levels after 24-hr at ambient temperature. Ambient temperature at the intake during March and April ranged from 4.3 to 9.9 C. Temperature increase through the cooling system was 11.5 to 18.1 above ambient temperature. Phytoplanktonic reductase activity was stimulated 25% after 6- to 9-hr exposure to these conditions. Photosynthetic rate of entrained phytoplankton was reduced at chlorine concentrations above and below 0.50 ppm. At 1.0 and 1.2 ppm chlorine concentrations, nitrate reductase activity was decreased by 15%. (See also W79-09235) (Chilton-ORNL)
W79-09257

GROWTH OF DUCKWEED UNDER CONSTANT AND VARIABLE TEMPERATURES,
Savannah River Ecology Lab., Aiken, SC.
R. R. Sharitz, and J. C. Luvall.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 410-419, 1978. 1 fig, 1 tab, 29 ref.

Descriptors: *Environmental effects, *Temperature, *Thermal pollution, Powerplants, Aquatic weeds, Growth rates, Duckweed, Spirodela oligorrhiza.

Populations of Spirodela oligorrhiza were exposed to cyclic, acyclic and constant temperature regimes. Cyclic and acyclic regimes ranged from 10 to 25 C. The number of adult fronds, determined at weekly intervals, was used as a measure of population growth. In all populations, rate of growth was highest at 25 C. Cyclic and Acyclic regimes did not result in growth rates which were significantly different from those at constant temperature equal to the mean of the range. It was concluded that population growth of the duckweed was related to temperature at all regimes. (See also W79-09235) (Chilton-ORNL)
W79-09258

GROWTH AND ECOLOGY OF SPARTINA ALTERNIFLORA IN MAINE AFTER A REDUCTION IN THERMAL STRESS,
Maine Univ. at Orono. Dept. of Botany and Plant Pathology.

M. Keser, B. R. Larson, R. L. Vadas, and W. McCarthy.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 420-433, 1978. 5 fig, 1 tab, 15 ref.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Thermal stress, Aquatic plants, Growth rates, Biomass, Density, Populations, Spartina alterniflora.

Relocation of surface thermal discharge through a diffuser system resulted in the termination of thermal stress to a population of Spartina alterniflora in Montsweag Bay, Maine. During the first year after diversion of the thermal discharge, no significant effect was observed in growth and recovery but during the following two years biomass and density increased slightly and shoot growth returned to prestress levels. Removal of a causeway in the area resulted in increased salinity, greater tidal amplitude and decreased summer temperatures. These factors contributed to a decline in biomass in relation to previous values. (See also W79-09235) (Chilton-ORNL)
W79-09259

EFFECTS OF REDUCED TEMPERATURES ON PREVIOUSLY STRESSED POPULATIONS OF AN INTERTIDAL ALGA,
Maine Univ. at Orono. Dept. of Botany and Plant Pathology.
R. L. Vadas, M. Keser, and B. Larson.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 434-451, 1978. 5 fig, 2 tab, 26 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Thermal stress, Temperature, Algae, Aquatic plants, Growth rates, Estuaries, Monitoring, Ascophyllum nodosum.

Reduced temperatures in an estuary near a nuclear power plant were brought about by relocation of surface thermal discharge through a diffuser and the removal of a causeway in the area. This reduction in temperature resulted in a return of populations of Ascophyllum nodosum populations to prestress levels. The reversal in Ascophyllum growth after elimination of thermal stress and changes in growth patterns caused by thermal alterations suggest that this species might be an effective candidate for monitoring stress in marine systems. (See also W79-09235) (Chilton-ORNL)
W79-09260

GENETIC AND PHYSIOLOGICAL FLEXIBILITY OF A CALANOID COPEPOD IN THERMAL STRESS,
Maryland Univ., Baltimore County, Baltimore. Dept. of Biological Sciences.
B. P. Bradley.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 452-469, 1978. 2 fig, 3 tab, 47 ref, 2 append. OWRT B-021-MD(2), NSF BMS-75-20282.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Copepods, Flexibility, Genetics, Animal physiology, Genetic flexibility, Physiological flexibility.

Temperature tolerances of individual copepods were measured as time to inactivity or to succomb to temperature shock. Results showed that Eurytemora populations vary considerably in genetic influence on temperature tolerance. Genes expressed themselves more clearly in males than in females. Most of the genetic variance appeared to be additive. Physiological variance was expressed more in females than in males. Field observations and laboratory experiments indicated that copepod populations in Chesapeake Bay are at or near their limit of survival in summer temperatures. It was concluded that the measures of physiological and genetic flexibility observed are not sufficient by themselves to predict the survival of Eurytemora in an even wider range of temperatures. (See also W79-09235) (Chilton-ORNL)
W79-09261

EFFECTS OF THERMAL EFFLUENTS ON REPRODUCTION IN A SEA ANEMONE,
California Univ., Berkeley. Dept. of Zoology.
B. L. Jennison.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 470-483, 1978. 6 fig, 1 tab, 13 ref.

Descriptors: *Environmental effects, *Temperature, Powerplants, Effluents, Reproduction, Aquatic animals, Adaptation, Anemones, Anthopleura elegantissima, Acclimation.

Reproduction of the sea anemone Anthopleura elegantissima was observed in the thermal outfall canal of a power plant and at a control site. Males from the thermal-outfall canal exhibited a delayed onset of gametogenesis but spawned as much as 1 month earlier than those in natural populations. Females in the outfall began gametogenesis at the same time as control animals but spawned earlier. Control females transplanted to the outfall underwent accelerated vitellogenesis and spawned 4 to 5 months ahead of either unmanipulated control or acclimated outfall anemones. Control anemones spawned during peak summer temperatures which may reach 15C while outfall anemones spawned after temperatures in the canal reached 25 C. It was concluded that outfall anemones have become acclimated to the warmer water. (See also W79-09235) (Chilton-ORNL)
W79-09262

A COMPARISON OF MORPHOMETRIC, BIOCHEMICAL, AND PHYSIOLOGICAL INDEXES OF CONDITION IN MARINE BIVALVE MOLLUSCS,
Woods Hole Oceanographic Institution, MA.
R. Mann.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 484-497, 1978. 2 tab, 54 ref. NOAA 04-6-158-44106.

Descriptors: *Environmental effects, *Temperature, Mollusks, Bioassay, Index of condition.

Laboratory and field data are used to determine the effect of temperature on gravimetric and volumetric meat/shell condition indexes; percentages of organic content, carbohydrate, carbon, and nitrogen; C/N and carbohydrate/N ratios; weight-specific ammonia excretion rates; and oxygen-consumption/ammonia-excretion ratios in several species of oyster, clam and mussel. Data indicated that volumetric or gravimetric assay of condition could be as meaningful as more complex biochemical assays. (See also W79-09235) (Chilton-ORNL)
W79-09263

RESPONSE OF MOSQUITOFISH TO THERMAL EFFLUENT,
Savannah River Ecology Lab., Aiken, SC.
D. H. Bennett, and C. P. Goodyear.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 498-510, 1978. 3 fig, 3 tab, 17 ref. DOE EY-76C-09-0819.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Fish, Reproduction, Size, Populations, Sexual maturity, Mosquitofish, Gambusia affinis, Body fat, Sex ratios.

Mosquitofish were sampled from three thermally affected stations (28 to 40C) and two unaffected stations (12 to 29C). The five populations were studied for reproductive activity, sex ratios, size at sexual maturity, percentage of fat, and size structure. Observations of reproductive activity showed that females with eyed embryos were found in populations from unaffected waters in June and in affected populations throughout the study period (February to December). Mean brood size of populations from thermally affected areas generally varied inversely with water temperature. Size at sexual maturity and sex ratios were similar in all populations. Body fat content varied seasonally with each population with percentages of fat being higher in males and juveniles from thermally affected waters. Mean size of females from unaffected areas was found to be directly related to water temperature but the size structure of populations from unaffected waters varied inversely with temperature. It was concluded that Gambusia affinis can adapt to severe thermal conditions. (See also W79-09235) (Chilton-ORNL)
W79-09264

RESPONSE OF A MOBILE INVERTEBRATE TO HETEROTHERMAL CONDITIONS,
Wisconsin Univ.-Madison. Lab. of Limnology.
S. J. Lozano, and J. F. Kitchell.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 511-521, 1978. 3 fig, 4 tab, 15 ref. OWRT A-070-WIS(4) and EPA R803971020.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Temperature, Cooling water, Amphipoda, Distribution patterns, Reproduction.

Hyalella azteca were collected from ten stations in a power plant cooling lake having a stable 15 C horizontal temperature gradient throughout the year. Seasonal temperatures ranged from 4 C at the cool end of the lake during winter to 45 C at the warm end in summer. Distribution and growth of H. azteca were restricted by the thermal characteristics of the lake. High summer temperatures excluded amphipods from 50% or more of the lake. Growth rate and duration of instar were accelerated by increased temperature but length frequency distributions showed greater growth at each instar at cooler temperatures. Reproduction occurred only during short time intervals in spring and fall as opposed to continuous summer reproduction in surrounding waters. It was concluded that amphipods respond to thermally altered conditions by altering their distribution. (See also W79-09235) (Chilton-ORNL)
W79-09265

TEMPERATURE SELECTION BY YOUNG TOPSMELT: LABORATORY AND FIELD INVESTIGATIONS,
Occidental Coll., Los Angeles, CA. Dept. of Biology.
K. F. Ehrlich, G. E. McGowen, and G. Muszynski.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 522-533, 1978. 3 fig, 2 tab, 25 ref.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Effluents, Fish, Fish behavior, Temperature, Distribution patterns, Topsmelt, Atherinops affinis.

The laboratory preferred-temperature range for Atherinops affinis during the period of 3 to 198 days post-hatching was determined to be 19 to 23 C. Temperatures warmer than 27 C were avoided by the topsmelt. The fish moved freely throughout the experimental chamber when it was at a uniform temperature but after the formation of a temperature gradient, the topsmelt became positioned in the compartment they initially selected. Selected temperatures were independent of acclimation temperatures. Shifting isotherms did not cause the fish to move until they contacted near lethal temperatures. The observed behavioral responses of topsmelt suggest that they may be attracted to warmed water but it does not imply that these conditions are necessarily beneficial to them. (See also W79-09235) (Chilton-ORNL)
W79-09266

MOVEMENT OF THREE SPECIES OF FISHES PAST A THERMALLY INFLUENCED AREA IN THE COOSA RIVER, ALABAMA,

Alabama Cooperative Fishery Unit, Auburn.
J. L. Moss, S. Boonyaratpalin, and W. L. Shelton.
In: Energy and Environmental Stress in Aquatic Systems. Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 534-545, 1978. 5 fig, 15 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Fish, Fish behavior, Fish passages, Fish barriers, Powerplants.

The objective of this study was to determine whether the cooling-water discharge from a coal-powered steam generating plant was an impassable barrier during warm months when thermal influence was maximum. Movement of ultrasonic-tagged largemouth bass and flathead and channel catfish passing the area was observed. Movement suggested that the fish avoided the area of maximum temperature by passing under or around it and that the heated water did not form an impassable barrier. (See also W79-09235) (Chilton-ORNL)
W79-09267

EFFECTS OF THERMAL EFFLUENT ON BENTHIC MARING INVETEBRATES DETERMINED FROM LONG-TERM SIMULATION STUDIES,
San Diego State Univ., CA. Center for Marine Studies.
R. F. Ford, D. G. Foreman, K. J. Grubbs, C. D. Kroll, and D. C. Watts.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 546-568, 1978. 1 fig, 5 tab, 23 ref.

Descriptors: *Environmental effects, *Thermal pollution, Effluents, Benthos, Growth rates, Mortality, Model studies.

The species studied in these simulation experiments on the effects of thermal effluents were the echinoid echinoderms Strongylocentrotus purpuratus and S. franciscanus, the asteroid echinoderms Pisaster ochraceus and P. giganteus, and the gastropod molluscs Astraea undosa, Kelletia kelletii, and Roperia poulsone. The sea urchin species showed low survival and impaired growth and condition in warmer temperatures with the effects being most pronounced among large adults. Growth and condition of the starfish were adversely affected by the effluents. K. kelletii and R. poulsoni were unaffected by the effluents. Growth and condition of A. undosa was adversely affected but survival was not affected. (See also W79-09235) (Chilton-ORNL)
W79-09268

EFFECTS OF THERMAL ALTERATION ON MACROINVERTEBRATE FAUNA IN THREE ARTIFICIAL CHANNELS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
D. E. Alston, J. M. Lawrence, D. R. Bayne, and F. F. Campbell.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 569-579, 1978. 1 fig, 2 tab, 19 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Invertebrates, Diptera, Oligochaetes, Density, Powerplants, Diversity.

During a 2-year study period, macroinvertebrates were collected at 4- to 6-week intervals from a control habitat receiving unheated water, a thermally stratified habitat receiving unheated and heated water, and a habitat receiving heated water only. Dominant organisms collected were oligochaetes and chironomid larvae. In dredge samples, overall mean diversities were not significantly different in the control habitat and the thermally stratified habitat but a lower diversity was found in the heated only water habitat. Plate samplers indicated highest diversity in the control habitat, intermediate diversity in the thermally stratified habitat and lowest diversity in the habitat receiving heated water only. More mayflies were present in the control and thermally stratified habitats. (See also W79-09235) (Chilton-ORNL)
W79-09269

EFFECTS OF POWER-PLANT OPERATION ON THE LITTORAL BENTHOS OF BELEWS LAKE, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. R. Lenat.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 580-596, 1978. 1 fig, 5 tab, 25 ref.

Descriptors: *Environmental effects, *Thermal pollution, Benthos, Powerplants, Lakes, Populations, Density, Biological communities, Thermal gradient, Biological gradient.

Populations of littoral benthos in a cooling reservoir of a power plant were studied over a three year period which included one preoperational year and two postoperational years. Approximately 150 taxa were recorded. Twenty-three of these were subjected to statistical analysis. It was found that changes in density for ten of these were associated with increases in temperature. Decreases in densities of Polypedilum digitifer, Nais communis, and Hyalella azteca were associated with increased temperature. Densities of Limnodrilus hoffmeisteri and Hexagenia munda increased with slight increases in temperature but declined at higher temperatures. Other taxa were indirectly affected by power-plant operation through changes in littoral macrophytes, periphyton, or other factors. Changes in community structure were assessed by the use of percent similarity coefficients. It was found that the imposition of a thermal gradient resulted in a corresponding biological gradient. (See also W79-09235) (Chilton-ORNL)
W79-09270

EFFECTS OF POWER-PLANT OPERATION ON THE PHYTOPLANKTON COMMUNITY OF BELEWS LAKE, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
P. H. Campbell.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 597-617, 1978. 3 fig, 3 tab, 34 ref.

Descriptors: *Environmental effects, *Thermal pollution, Powerplants, Phytoplankton, Biological communities, Populations, Density, Lakes, North Carolina, Dominant organisms, Diversity.

The phytoplankton community in a cooling reservoir of a power plant was studied over a 4-year period which included two preoperational and two postoperational years. Comparison of surface water circulation patterns revealed an increase in spatial homogeneity of the phytoplankton after power-plant operation began. Although general successional changes in phytoplankton were observed after operation began, no major changes in standing crop were found. Chlorophyceae and Dinophyceae dominance increased while Bacillariophyceae dominance showed a decrease. Mean total cell densities and enrichment indexes decreased during the 4 year period and mean total biovolumes, numbers of taxa and Shannon-Weaver diversity indexes increased. (See also W79-09235) (Chilton-ORNL)
W79-09271

EFFECTS OF POWER-PLANT OPERATION ON THE ZOOPLANKTON COMMUNITY OF BELEWS LAKE, NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
T. P. Anderson, and D. R. Lenat.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, Novenber 2-4, 1977. CONF-771114. p 618-641, 1978. 7 fig, 5 tab, 30 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Zooplankton, Biological communities, Populations, Powerplants, Density, Dominant organisms.

The zooplankton community in a cooling reservoir of a power plant was studied over a 3-year period which included one preoperational and two postoperational years. Probably the most notable influence of the power-plant operation on the zooplankton community of the lake was that the circulation of surface waters appeared to reduce station density differences and bring about a more similar seasonal density distribution for most taxa. Three species appeared to respond to power-plant operation. Hexarthra and Ptygura spp. increased in density and a winter increase in density of Polyarthra was also noted. Causes other than power-plant operation appeared to relate to other changes in the zooplankton community. (See also W79-09235) (Chilton-ORNL)
W79-09272

STOCHASTIC APPROACH TO PREDICT SURVIVAL OF ESTUARINE ANIMALS EXPOSED TO HOT DISCHARGE EFFLUENT,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
K. S. Chung, and K. Strawn.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 642-662, 1978. 2 fig, 1 tab, 17 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Model studies, Powerplants, Cooling water, Crustaceans, Fish, Mortality, Forecasting, Estimating.

In the stochastic model used, aquatic animals were exposed to hot discharge effluent for 180 minutes. Temperature ranged from 7.2 to 30.5 C in the intake canal, from 19.4 to 41.6 C in the discharge canal above the cooling towers, and from 14.4 to 37.8 C below the towers. Seasonal mortality rates of 8 species of crustaceans and 46 fishes were estimated at several test temperatures for each of three seasons. During the hot season, mortality rates were 23% or more for most organisms at 40 C and 0 for most organisms at 35 C. In terms of average seasonal temperature, survival probabilities ranged from 0 to 96% from June-September and from 0 to 61% for the 56 species tested. Despite two weaknesses of the model (death rates were estimated from laboratory experiments rather than from field observations, and cumulative dosage and acclimation in the discharge canal afferent to the cooling towers were not considered), the model was accepted as adequately descriptive of seasonal survival of animals in the discharge-canal system. (See also W79-09235) (Chilton-ORNL)
W79-09273

PATHOGENIC SPECIES OF THERMOPHILIC AND THERMOTOLERANT FUNGI IN REACTOR EFFLUENTS OF THE SAVANNAH RIVER PLANT,
Indiana Univ., Bloomington. Dept. of Biology.
M. R. Tansey, and C. B. Fliermans.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium, Augusta, Georgia, November 2-4, 1977. CONF-771114. p 663-690, 1978. 2 fig, 4 tab, 17 ref. DOE AT(07-2)-1.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Powerplants, Cooling water, Fungi, Effluent, Savannah River Plant, Pathogenic fungi, Animal diseases.

Analysis of foam, water, microbial mats, plant debris, air, and soils from sites of elevated and ambient temperatures showed that except for Dactylaria gallopava, populations of thermotolerant and thermophilic fungi were not significantly different at elevated and ambient temperature sites. Dactylaria gallopava was directly associated with effluents having temperatures of 44 C or higher and was abundant in microbial mats, foam, and soils at the edges of cooling-water effluents. (See also W79-09235) (Chilton-ORNL)
W79-09274

RESPONSES OF THE ALLIGATOR TO INFECTION AND THERMAL STRESS,
Medical Univ. of South Carolina, Charleston. Dept. of Lab. Medicine.
A. B. Glassman, and C. E. Bennett.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 691-702, 1978. 6 fig, 11 ref. ERDA EY-76-S-09-0965.

Descriptors: *Environmental effects, *Thermal pollution, Thermal stress, Bacteria, Animal diseases, Reptiles, Alligator mississippiensis.

Peripheral blood components and serum protein electrophoretic patterns were studied in normal Alligator mississippiensis vs alligators infected by Aeromonas hydrophila and/or thermally stressed alligators. Thermal stress appeared to have a major effect on host response. Alligators maintained at 20, 25, 30, and 35 C had similar base-line levels of white blood cell counts. After infection their white blood cells and neutrophilic macrophages were maximum at 30 C (a temperature corresponding to optimum recovery of infected animals). Exposure to 35 C resulted in slightly lower neutrophilic macrophage numbers and death. It was concluded that A. mississippiensis is sensitive to bacteria when heat stressed. (See also W79-09235) (Chilton-ORNL)
W79-09275

ACCLIMATION STATES OF JUVENILE STRIPED BASS HELD IN CONSTANT AND FLUCTUATING TEMPERATURE REGIMES,
Oak Ridge National Lab., TN. Environmental Sciences Div.
D. K. Cox.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 703-713, 1978. 3 fig, 2 tab, 19 ref. DOE W-7405-eng-26.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Striped bass, Juvenile fish, Acclimation state, Fluctuating temperature, Constant temperature.

Using young-of-the-year striped bass as test species and equilibrium loss at high temperatures as the measure of acclimation state, this study compares acclimation patterns developed in fish in fluctuating temperature with those developed in constant temperatures. Striped bass in this study exhibited acclimation states higher than the constant average temperatures but lower than the maximum temperatures of the cycle. Higher acclimation states were reached with more rapid cycling. Time of day and light did not appear to have any effect. It was concluded that tolerance data developed at constant acclimation temperatures will underestimate survival in fluctuating temperature regimes. (See also W79-09235) (Chilton-ORNL)
W79-09276

EFFECTS OF ACUTE AND CHRONIC THERMAL EXPOSURES ON THE EGGS OF THREE HUDSON RIVER ANADROMOUS FISHES,
Ecological Analysts, Inc., Middletown, NY.
E. L. Kellogg, J. J. Salerno, and D. L. Latimer.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 714-725, 1978. 3 tab, 12 ref.

Descriptors: *Environmental effects, *Thermal pollution, Thermal stress, Temperature, Powerplants, Embryonic growth stage, Fish, Striped bass, Alewife, Atlantic tomcod.

In order to assess the thermal impact of Hudson River power plants, Atlantic tomcod, alewife, and striped bass eggs were tested for chronic and acute tolerance to elevated temperatures. Results showed that upper lethal temperatures for normal hatching success were 26.5 C for alewife eggs, 26.3 C for striped bass eggs, and 6.6 C for Atlantic tomcod eggs. As the stage of embryonic development advanced, thermal tolerance of eggs exposed for 5 to 60 minutes increased. As duration of exposure increased, thermal tolerance of eggs decreased. (See also W79-09235) (Chilton-ORNL)
W79-09277

MULTIPLE-FACTOR AND SYNERGISTIC STRESSES IN AQUATIC SYSTEMS,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
F. J. Vernberg.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 726-747, 1978. 5 fig, 73 ref.

Descriptors: *Environmental effects, Stress, Aquatic environment, Aquatic life, Multiple-factor stresses, Synergism.

This paper reviews recent research efforts dealing with the influence of multiple factors on organisms in aquatic systems. It emphasises recent literature which illustrates some distinct research areas and discusses problems which discourage multiple-factor studies. These problems include technological limitations of equipment to control and selectively vary a number of factors and the underdeveloped state of the statistical and computer methodology necessary to handle complex data. (See also W79-09235) (Chilton-ORNL)
W79-09278

ORDINATION OF MACROINVERTEBRATE COMMUNITIES IN A MULTISTRESSED RIVER SYSTEM,
Cincinnati Univ., OH. Dept. of Biological Sciences.
D. C. Beckett.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a Symposium, held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 748-770, 1978. 5 fig, 4 tab, 41 ref.

Descriptors: *Environmental effects, *Water pollution, Stress, Invertebrates, Biological communities, Rivers, Flow, Multiple-factor stresses, Ordination.

Fourteen stations over three time periods were used to investigate changes in biotic composition on a longitudinal and a temporal basis. Modifications in the pattern of relationships between communities owing to changes in river discharge and other physical-chemical parameters were also studied. Based on similarity indices, the stations showed patterns of affiliation which correlated with changes in river discharge. During periods of relatively high river discharge, a high degree of faunal similarity was seen between far upstream and far downstream stations. During low flow conditions, pollutional influences caused a biotic homogeneity among all downstream stations. During high river discharge periods, ordination of stations did not produce an ordering along any gradients but, under low flow conditions, stations ordered well along a gradient of pollutional disturbances. (See also W79-09235) (Chilton-ORNL)
W79-09279

LONGITUDINAL VARIATION IN THE MACROINVERTEBRATE FAUNA AND WATER CHEMISTRY OF AN EASTERN PENNSYLVANIA TROUT STREAM,
Lehigh Univ., Bethlehem, PA. Dept. of Biology.
P. T. Bradt.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 771-784, 1978. 2 fig, 2 tab, 36 ref.

Descriptors: *Environmental effects, *Water pollution, Water quality, Water chemistry, Invertebrates, Benthos, Urbanization, Pennsylvania, Brown trout.

Over a period of 17 months temperature, pH, total alkalinity, conductivity, orthophosphate, nitrate, chloride, and total iron were measured at eight stations on Bushkill Creek and benthos were sampled at four stations. Longitudinal variation was noted in both the water chemistry and in benthos. All chemical parameters increased downstream. Biomass, total numbers and number of taxa decreased at the downstream station which was located in an urban area. Dominant organisms changed from Stenonema at the upstream station to Hydropsyche at the two midstream stations to Chironomidae at the downstream station. It was concluded that stresses on the stream from urbanization must be minimized if the stream is to continue supporting a reproducing brown trout population. (See also W79-09235) (Chilton-ORNL)
W79-09280

THE EFFECT OF IONIZING RADIATION ON THE THERMAL TOLERANCE OF MOSQUITOFISH,
Oak Ridge National Lab., TN. Environmental Sciences Div.
B. G. Blaylock, and M. L. Frank.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 785-793, 1978. 2 tab, 17 ref.

Descriptors: *Environmental effects, *Thermal stress, Resistance, Radiation, Fish, Thermal tolerance, Mosquitofish.

Gambusia affinis were exposed to doses of radiation ranging from 500 to 5000 rads from a Co60 source. Results of CTM type tests showed that only at 1500 rads and day 15 after irradiation was the value significantly different from the controls. Greatest range of individual CTM values (38.1 to 40.6 C) was also found at this dose and time. Tissues of Gambusia irradiated with 500 and 1500 rads were examined for pathological changes at 5, 15, and 30 days after irradiation. At 1500 rads after 5 days, atrophy of the hematopoietic tissues and gonads were observed. At 1500 rads, mean survival time was significantly different at day 5 and at day 15. Recovery had taken place by day 30. (See also W79-09235) (Chilton-ORNL)
W79-09281

RESPONSES OF ICHTHYOPLANKTON TO STRESSES SIMULATING PASSAGE THROUGH A POWER-PLANT CONDENSER TUBE,
New York Univ., Medical Center, Tuxedo. Inst. of Environmental Medicine.
G. V. Poje, T. C. Ginn, and J. M. O'Connor.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 794-808, 1978. 5 fig, 2 tab, 18 ref.

Descriptors: *Environmental effects, *Model studies, Larvae, Striped bass, Carp, Temperature, Flow, Biocides, Pressure, Powerplants, Simulator, Multiple factor stresses, Condenser tubes.

Carp and striped bass larvae were exposed for 5 min total to a variety of stresses in a power-plant condenser-tube simulator. Three sets of experimental conditions were used: (1) temperature was varied while a flow velocity of 1.22 m/sec and minimum pressure of 0.51 atm was maintained; (2) flow was varied while a constant, sublethal temperature increase (rise of 0 and 8.2 C for bass and 16.7 C for carp) was maintained; and (3) biocide concentrations were varied at constant velocity and temperature changes. Due to combined stresses, the survival pattern which developed was complicated. Carp larvae exhibited significantly higher latent mortalities at temperature changes of 18.1 C while striped bass were most sensitive at changes of 15.5 C. (See also W79-09235) (Chilton-ORNL)
W79-09282

EFFECTS OF SIMULATED ENTRAINMENT ON THE BIOLOGY OF A FRESHWATER CLADOCERAN,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
A. L. Buikema, Jr., S. R. Sherberger, G. W. Knauer, L. A. Newbern, and J. T. Reading.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-

771114. p 809-825, 1978. 2 fig, 6 tab, 37 ref.

Descriptors: *Environmental effects, *Entrainment, *Model studies, Powerplants, Freshwater, Daphnia, Crustaceans, Chlorine, Temperature, Combined stresses, Multiple factor stress.

In a 12-min period, Daphnia pulex were exposed separately and in combination to temperature, chlorine, and mechanical stresses under simulated entrainment conditions. Mechanical stress had the greatest effect on survival. Temperature was the second most important parameter affecting cladoceran biology. A 14 C stress significantly reduced oxygen consumption and 10 to 14 C stresses reduced filtering rates. Thermal stress did not affect growth, molting or reproduction when food was abundant. Poor food quality caused a significant reduction in the number and vitality of young produced by females exposed to 10 C stress or to combined stress. ATP levels were reduced by chlorine and combined stress. (See also W79-09235) (Chilton-ORNL)
W79-09283

THE AVOIDANCE RESPONSE OF THE COMMON SHINER TO TOTAL AND COMBINED RESIDUAL CHLORINE IN THERMALLY INFLUENCED DISCHARGES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
D. S. Cherry, S. R. Larrick, J. D. Giattina, K. L. Dickson, and J. Cairns, Jr.
In: Energy and Environmental Stress in Aquatic Systems, Selected Papers from a symposium held at Augusta, Georgia, November 2-4, 1977. CONF-771114. p 826-837, 1978. 2 fig, 2 tab, 22 ref.

Descriptors: *Environmental effects, *Thermal stress, *Chlorine, Fish, Fish behavior, Powerplants.

Chlorine avoidances of the common shiner were evaluated by treating river water with doubling increments of total residual chlorine (TRC) from 0.025 to 0.40 mg/l. Depending on the acclimation temperature tested, the first threshold avoidance to TRC occurred at levels varying from 0.10 to 0.20 mg/l. Combine residual chlorine (CRC) and free residual chlorine (FRC) at this level varied from 0.077 to 0.159 and 0.035 to 0.122 mg/l respectively. Variation in threshold avoidance concentrations for fractions within the TRC was lowest for HOCl. In chloramine trials conducted at 12 and 24 C, avoidances first occurred at 0.207 and 0.205 mg/l, respectively. Fish acclimated at 12 and 24 C and tested at 17.6 and 26.8 C, respectively, showed threshold avoidances at 0.211 and 0.209 mg/l. At 12 and 24 C, chloramine avoidance thresholds were 0.399 and 0.195 mg/l, respectively. It was concluded that the common shiner is less influenced by chloramine and more sensitive to a low threshold of HOCl in TRC treatments. (See also W79-09235) (Chilton-ORNL)
W79-09284

WATER POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09320

5D. Waste Treatment Processes

PRESENT AND FUTURE WATER POLLUTION CONTROL PROJECTS IN JAPANESE RIVERS AND LAKES,
Ministry of Construction, Tokyo (Japan). River Improvement Div.
For primary bibliographic entry see Field 5C.
W79-09115

AN OVERVIEW OF BOTTOM SEDIMENT PROBLEMS IN SAGINAW RIVER AND BAY, MARINETTE-MENOMINEE HARBOR, AND WAUKEGAN HARBOR,
Environmental Protection Agency, Chicago, IL. Region V.
For primary bibliographic entry see Field 5A.
W79-09125

5E. Ultimate Disposal Of Wastes

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME 1: DISCUSSION,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
R. A. Jones, and G. F. Lee.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-45, Vol. I, August 1978. 208 p, 15 tab, 12 fig, 1 append, 90 ref.

Descriptors: *Environmental effects, *Wastes, *Dredged material, *Dredged material disposal, *Elutriate tests, *Open water disposal.

The elutriate test was developed to predict release of chemical contaminants from dredged sediments upon open-water disposal. This study evaluates factors influencing results of the elutriate test and its reliability in predicting release of contaminants during dredged material disposal operations. Sediment samples were taken from various waterways in the U.S. These samples were subjected to the standard and modified elutriate test to examine the influence of various factors on the test results. Field studies were also conducted at various locations and comparisons were made of the results of the standard and modified elutriate tests and water column concentrations during disposal operations. These studies showed the standard elutriate test, involving 30-minute mixing and one-hour settling, is a reliable test for predicting the potential release of contaminants associated with hydraulically dredged sediments dumped in open water. The standard tests should be conducted with compressed air. Air bubbles, in addition to mixing the solution, also keep the system oxic, thus simulating the conditions of importance for water column organisms at the dredged material disposal site. The elutriate test should continue to be used to evaluate potential release of contaminants at a dredged material disposal site involving open-water dumping or discharge of sediments. (See also W79-09086) (WES)
W79-09085

EVALUATION OF THE ELUTRIATE TEST AS A METHOD OF PREDICTING CONTAMINANT RELEASE DURING OPEN-WATER DISPOSAL OF DREDGED SEDIMENTS AND ENVIRONMENTAL IMPACT OF OPEN-WATER DREDGED MATERIAL DISPOSAL; VOLUME II: DATA REPORT,
Texas Univ. at Dallas, Richardson. Dept. of Environmental Chemistry.
G. F. Lee, R. A. Jones, F. Y. Saleh, G. M. Mariani, and D. H. Homer.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A061 710, Price codes: A99 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-45, August 1978, (1 volume in 2). 1234 p, 526 tab, 192 fig, 1 append, 39 ref.

Descriptors: *Environmental effects, *Wastes, *Dredged material, *Dredged material disposal, *Elutriate test, *Open water disposal.

The elutriate test was developed to predict release of chemical contaminants from dredged sediments upon open-water disposal. This study evaluates factors influencing results of the elutriate test and its reliability in predicting release of contaminants during dredged material disposal operations. Sediment samples were taken from various waterways in the U.S. These samples were subjected to the standard and modified elutriate test to examine the influence of various factors on the test results. Field studies were also conducted at various locations and comparisons were made of the results of the standard and modified elutriate tests and water column concentrations during disposal operations. These studies showed the standard elutriate test, involving 30-minute mixing and one-hour settling, is a reliable test for predicting the potential release of contaminants associated with hydraulically dredged sediments dumped in open water. The standard tests should be conducted with compressed air. Air bubbles, in addition to mixing the solution, also keep the system oxic, thus simulating the conditions of importance for water column organisms at the dredged material disposal site. The elutriate test should continue to be used to evaluate potential release of contaminants at a dredged material disposal site involving open-water dumping or discharge of sediments. (See also W79-09085) (WES)
W79-09086

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, WINDMILL POINT MARSH DEVELOPMENT SITE, JAMES RIVER, VIRGINIA; SUMMARY REPORT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. D. Lunz, T. W. Zeigler, R. T. Huffman, R. J. Diaz, and E. J. Clairain.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A066 224, Price codes: A07 in paper copy, A01 in microfiche. Technical Report D-77-23, August 1978. 116 p, 25 fig, 19 tab, 33 ref.

Descriptors: *Habitats, *On-site investigations, *Dredged material, *Habitat development, *Marsh development, *James River(VA).

A marsh habitat was developed using fine-textured inorganically and organically enriched sediments dredged from the James River navigation channel in winter of 1974-75. From autumn 1974 to September 1977, engineering and ecological activities documented marsh construction operations and environmental alterations that accompanied the marsh habitat development. The hydraulic construction of an inexpensive sand dike on a soft river bottom foundation and the ability of the dike to contain fine-grained hydraulically dredged sediments were demonstrated. Ecological monitoring and experimental studies of plants, soils, sediment and water quality; fish, aquatic invertebrate, and wildlife communities; and metals and chlorinated hydrocarbon compound uptake by marsh plants were also conducted. The ecological studies contrasted preconstruction and postconstruction conditions and compared postconstruction conditions with natural marsh habitat. The freshwater intertidal, semi-contained and upland dredged material substrate was nearly covered with over 75 types of naturally invaded plants within 6 months following construction. Channel sediments were slightly modified by the disposal operation. Natural reference marsh substrate characteristics more closely resembled original channel sediments than modified channel sediments forming the experimental marsh substrate. Two years following construction, apparent chemical equilibrium had developed, and tidal chemical conditions at the natural and experimental marshes were similar. (WES)
W79-09087

ANNOTATED TABLES OF VEGETATION GROWING ON DREDGED MATERIAL THROUGHOUT THE UNITED STATES,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. C. Landin.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A068 459, Price codes: A08 in paper copy, A01 in microfiche. Miscellaneous Paper D-78-7, December 1978. 155 p, 6 tab, 48 ref.

Descriptors: *Vegetation establishment, *Vegetation, *Dredged material, *Waste disposal sites.

Presents data collected on the vegetation of dredged material islands and sites in Corps of Engineer-maintained waterways throughout the United States. More than 2000 dredged material islands and numerous dredged material sites have been built in the past 100 years; 202 of these were intensively sampled and all vegetation recorded, identified, and/or collected as voucher specimens. Six tables present: a. An anotated listing by

common name of 1120 plant species occurring on dredged material. b. A selection of 361 upland and high marsh plant species and 115 wetland plant species that may be planted on dredged material for wildlife habitat enhancement and/or substrate stabilization. c. Matrixes of the 361 upland and the 115 wetland plant species. d. An alphabetical group listing by scientific name and authority of the 1120 plant species occurring on dredged material. These data were prepared to provide managers with data for planned plant establishment on wetland and upland dredged material islands and sites throughout the United States. (WES)
W79-09088

HABITAT DEVELOPMENT FIELD INVESTIGATIONS, MILLER SANDS MARSH AND UPLAND HABITAT DEVELOPMENT SITE, COLUMBIA RIVER, OREGON; APPENDIX E: POSTPROPAGATION ASSESSMENT OF BOTANICAL AND SOIL RESOURCES ON DREDGED MATERIAL,
Washington State Univ., Pullman.
P. E. Heilman, D. M. Greer, S. E. Brauen, and A. S. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A062 261, Price codes: A17 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-38, App. E, August 1978. 393 p, 52 fig, 118 tab, 1 append, 38 ref.

Descriptors: *Marshes, *Marsh plants, *Vegetation establishment, *Soil analysis, *Columbia River, *Dredged material, *Habitat development, *Waste disposal site.

Describes the study area, methods, and results of habitat development experiments conducted at Miller Sands, a dredged material disposal site near the mouth of the Columbia River. Consists of investigations and experimental plantings on the older upland portion of the island and on the more recently constructed spit and marsh area. Soil analyses showed relatively uniform soil conditions with sand texture on both experimental sites. Soil samples taken in the marsh in September 1976 after the first season's growth of propagated plants and the first application of the split fertilizer treatments showed significantly increased levels of ammonium and potassium and a reduction in soil pH corresponding to treatment rates. Available phosphorus determined by the oxalate method of extraction was not related to fertilizer treatment. Samples taken in June 1977 showed some increases in fertility probably as a result of the second fertilizer treatment on the split application plots, but, by August 1977, fertility levels had declined and showed little relationship to fertilizer treatment. A significant reduction in available N and exchangeable K due to uptake by plants was noted on the transplant plots, especially in the 1977 samples. (WES)
W79-09089

PREDICTING AND MONITORING DREDGED MATERIAL MOVEMENT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
B. W. Holliday, B. H. Johnson, and W. A. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 878, Price codes: A03 in paper copy, A01 in microfiche. Technical Report DS-78-3, December 1978. 44 p, 5 fig, 1 tab, 12 ref.

Descriptors: *Sediment transport, *Monitoring, *Forecasting, *Dredged material, *Dredged material disposal, Waste disposal sites.

Summarizes results from three work units (1B06, 1B07, and 1B09) of the Dredged Material Research Program, concerned with predicting and monitoring dredged material movement. Work Units 1B06 and 1B09 concerned predicting the short-term fate of dredged material discharged in open water. 1B06 was an evaluation and calibration of the Tetra Tech disposal models (developed under Work Unit 1B02 of the DMRP by Tetra Tech, Inc.) using field data collected at several disposal sites, including the Duwamish, New York Bight, and Lake Ontario sites. This field data was collected under Work Unit 1B09 by Yale University. Work Unit 1B07 evaluated two two-dimensional finite element models (developed under Work Unit 1B05 of the DMRP by the University of California at Davis) for the long-term prediction of sediment transport in estuaries. Part II of the report discusses the modifications of the Tetra Tech models made by the U.S. Army Engineer Waterways Experiment Station and presents calibration results using field data from the Duwamish, New York Bight, and Lake Ontario disposal sites. Part III of the report discusses the factors in the long-term transport of sediment in estuaries and how they are handled by finite element models. (WES)
W79-09090

EVALUATION OF LAWS AND REGULATIONS IMPACTING THE LAND USE OF DREDGED MATERIAL CONTAINMENT AREAS,
Science Applications Inc., La Jolla, CA. Environmental Science Div.
J. Cole, and M. Brainard.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 905, Price codes: A13 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-78-55, September 1978. 265 p, 9 append, 2 tab, 31 ref.

Descriptors: *Land use, *Regulation, *Containment areas, *Dredged material, *Dredged material disposal.

Investigates laws and regulations of Federal, state, or local origin that encourage or discourage productive end uses of new land created by the confined disposal of dredged material produced by navigation channel improvement projects. A search was made for all Federal laws and regulations and the laws of 16 states where most confined disposal activities are taking place. Charters and regulations issued by the port districts or port authorities in the 16 states were also reviewed. All laws and regulations found that could have impact on land use decisions, including procedures for preparation and review of environmental impact assessments, are summarized. The most restrictive provisions were incorporated into scenarios for the application of permits to make productive uses of filled dredged material containment areas, and these were analyzed to develop strategies to overcome legal constraints on end use of this land. All provisions in the law promoting productive uses of land created by dredge-fill operations are summarized and used in structuring viable strategies for overcoming constraints noted in other jurisdictions. Conclusions and recommendations include approaches to the incorporation of a dredged material containment area 'location and end use' element in Level A, B, and C plans for river basins. (WES)
W79-09091

DENSIFICATION, TREATMENT, AND MANAGEMENT OF DREDGED MATERIAL DISPOSAL AREAS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
C. C. Calhoun, Jr.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 273-289, 1978. 5 fig, 17 ref.

Descriptors: *Dredging, *Waste disposal, *Sediments, Soils, Soil disposal fields, Soil moisture, Soil properties, Surface water, Waste treatment, Flocculation, Polychlorinated biphenyls.

Work within the Disposal Operations Project of the Dredged Material Research Program related to the densification and treatment of dredged material and the management of containment areas is described. The process of dewatering/densifying dredged material through progressive trenching is discussed and the results of a major field test are given. Results of laboratory and field tests on the treatment of contaminated dredged material with chemical flocculants are presented. An integrated management approach for containment areas is presented through a generalized decision network. (See also W79-09113) (Deal-EIS)
W79-09130

THE RIVER DEE REGULATION SCHEME: OPERATIONAL EXPERIENCE OF ON-LINE HYDROLOGICAL SIMULATION,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
A. O. Lambert.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 29 p, 7 fig, 1 tab, 3 ref, 2 append.

Descriptors: *River regulation, *Real time, *Flood forecasting, *Mathematical models, *Telemetry, *River Dee(North Wales-UK), Low flow, Computers, Control, Simulation analysis, Hydrometric data, On-line, Management data, Costs, Benefits, Projects, Systems analysis.

In 1966, the River Dee was selected as a natural testing area for the development of new methods of hydrological modeling, real-time prediction and control, together with associated instrumentation and telemetry systems. This paper considers the implementation and use of models, including logistics, costs and benefits of operating high capital cost installations. Emphasized is the experience gained on the logistics of real-time hydrologic modeling, the choice of model structure and its fundamental effect on data input requirements, the relative importance of measured and forecast rainfall, and other similar matters. As a result of the Dee Research Project, the Welsh Water Authority now enjoys the benefits of a sophisticated telemetry system, with on-line hydrological simulation and forecasting capability, to assist in their multipurpose management of the River Dee System. Operational experience has shown that it is advantageous to use relatively simple hydrological models for on-line forecasting. (See also W79-09285) (Bell-Graf--Cornell)
W79-09293

5G. Water Quality Control

THE TOXIC SUBSTANCES CONTROL ACT (TSCA): HOW IT AFFECTS EPA FROM A RESEARCH AND ENFORCEMENT STANDPOINT,
Environmental Protection Agency, Washington, DC. Office of Toxic Substances.
For primary bibliographic entry see Field 5C.
W79-09122

WESTERN WATER LAW AND IRRIGATION RETURN FLOW,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 6E.
W79-09172

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W79-09180

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE, PROCEEDINGS, 1978 CORNELL AGRICULTURAL WASTE MANAGEMENT CONFERENCE.
Ann Arbor Science Publishers Inc., Ann Arbor, Michigan, 1979. 740 p.

Descriptors: *Model studies, Conferences, Water quality control, Water pollution control, Water quality act, Federal water pollution control act, Conservation, Wastes, *Nonpoint sources, *Farm practices, Farm management, *Forest practices, Forest management, *Silviculture.

The papers presented at the 1978 Cornell Agricultural Waste Management Conference were grouped into the following catagories and published: Governmental aspects; Approaches for Best Management Practice (BMP) selection; Nutrient management; Silviculture; Economic, policy and institutional aspects; State and watershed approaches; and Modeling Studies. The emphasis for control of nonpoint pollution sources was placed upon the use of BMP's rather than on the collection, treatment and effluent standards approach used for control of point sources. (See W79-09186 thru W79-09230) (Skogerboe-Colorado State)
W79-09185

IMPROVING WATER QUALITY IN AGRICULTURE AND SILVICULTURE,
Department of Agriculture, Washington, DC.
D. G. Unger.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 11-16, 1979.

Descriptors: *Water quality control, *Water pollution control, Water law, Water management(Applied), Programs, Federal water pollution control act, Federal project policy.

This paper reports the viewpoints of U.S. Department of Agriculture on America's water quality needs and the programs designed to meet them. It was stressed that the overall job of upgrading water quality requires an effective combination of good management, technical assistance, economic incentives, research and education. (See also W79-09185) (Skogerboe-Colorado State)
W79-09187

A STATE PERSPECTIVE ON NONPOINT SOURCE MANAGEMENT,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5B.
W79-09188

RESEARCH NEEDS AND CURRENT ACTIVITIES,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
T. A. Murphy.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 25-30, 1979.

Descriptors: Water quality control, Water management(Applied), Soil conservation, *Water conservation, Management, Federal project policy, Mathematical models, Environmental control, *Agricultural research, *Research priorities.

This paper focused on broad topics regarding the renewable resources industry, including the current concerns, issues, and emerging environmental problems. The role of EPA in agricultural research was discussed in terms of both the nature and extent of activities, within the context of cooperation with the agribusiness community. Reliance on typical soil and water conservation measures as best management practices for maintenance of water quality was viewed from the perspective of present technical knowledge and system assessment capabilities. Additional studies necessary to confirm the link between water quality and best management practices were suggested. It was suggested that improved monitoring techniques, in-stream water quality surveys, and a better understanding of sediment/pollutant adsorption and desorption mechanisms are required in the near future to sharpen the guidelines for establishing agricultural nonpoint source management systems. Needed area-wide pollution problem assessment methodologies, BMP field evaluation, mathematical modeling of transport phenomena, and predictive techniques for BMP system comparisons were outlined. The projected extent of EPA/ORD involvement in these future activities was examined in light of potential resource availability and was compared with similar activities in other Federal, State, and local agencies and institutions. (See also W79-09185) (Skogerboe-Colorado State)
W79-09189

THE ROLE OF CONSERVATION PRACTICES AS BEST MANAGEMENT PRACTICES,
Soil Conservation Service, Washington, DC.
J. S. Johnson.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 69-78, 1979. 16 ref.

Descriptors: *Water pollution control, Water quality control, Water quality act, Soil conservation, Management, Water pollution sources, Irrigation, Water conservation, *Farm practices, Nonpoint sources.

The combination of conservation practices selected to meet the needs of a particular land and water problem and achieve the desired results was viewed as a resource management system. Experience and research have shown that many resource management systems are highly effective in protecting and improving water quality. The resource management system selected may include agronomic, managerial, and structural practices that reduce nonpoint source pollution and protect water quality. The best resource management system is one that keeps the water where it falls, protects the resource base, and maintains water quality of the water that runs off. It was suggested that such proved resource management systems can be used in achieving national goals of improved water quality, and because of the recognized effectiveness of conservation practices and resource management systems in controlling nonpoint source pollution, many of them can be selected and listed as BMP in Section 208 Water Quality Management plans. (See also W79-09185) (Skogerboe-Colorado State)
W79-09192

RELATIONSHIPS BETWEEN AGRICULTURAL LAND AND WATER QUALITY,
Department of Agriculture, Ottawa (Ontario). Central Experimental Farm.
D. R. Coote, E. M. MacDonald, and R. DeHaan.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 79-92, 1979. 5 tab, 11 ref.

Descriptors: *Land use, *Agricultural watersheds, Agricultural chemicals, Statistical methods, Great Lakes, Regression analysis.

The study described in this paper was developed as an adjacent to the Pilot Watershed Studies of the International Reference Group on Great Lakes Pollution from Land Use Activities (PLUARG) of the International Joint Commission (IJC) with the objective of determining the relationships among water quality, pollutant loadings and land use data gathered in watersheds representative of different agricultural areas. The approach taken was to: (1) identify and survey a number of purely agricultural watersheds (nonagricultural land use essentially absent) representative of different agricultural systems in the Canadian Great Lake Basin; (2) monitor the water quality at the watershed outlet; and (3) examine statistical relationships between the characteristics of these watersheds and the water quality observed at their outlets. A further objective of the study was to provide a basis for predictions of water quality in unmonitored agricultural areas of the Canadian Great Lakes Basin. (See also W79-09185) (Skogerboe-Colorado State)
W79-09193

INTEGRATING WATER QUALITY AND BEST MANAGEMENT PRACTICES,
New York State Assembly Research Staff, Albany.
A. F. Taverni, and R. F. Dworsky.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 93-115, 1979. 4 fig, 6 tab, 15 ref.

Descriptors: *Water quality control, Water pollution control, Water quality act, Planning, Management, Hudson River, Salinity, *Farm practices.

This paper discussed in detail the New York State Level B plans (section 209 of Public Law 92-500) which contribute to improved water quality through the use of common techniques. Specifically, this paper focused on the Genesee River, Hudson River and Lake Champlain. It provided a summary of Best Management Practices and the relation of Best Management Practices to overall water quality management. Lastly, this paper demonstrated the viability of a state integrated planning approach. (See also W79-09185) (Skogerboe-Colorado State)
W79-09194

ENVIRONMENTAL IMPLICATIONS OF TRENDS IN AGRICULTURE AND SILVICULTURE,
Development Planning and Research Associates, Inc., Manhattan, KS.
S. G. Unger.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 117-131, 1979. 1 fig, 2 tab.

Descriptors: Environmental sanitation, Pollutant identification, *Water pollution sources, Water quality control, Agriculture, Pasture management, Range management, *Forest management, Environmental control, Pollution abatement, *Farm management.

In a study sponsored by the Environmental Protection Agency (EPA) the environmental implications of production-related trends were assessed in the following five sub-sectors: Agriculture--(1) Nonirrigated crop production, (2) Irrigated crop production, (3) Livestock feedlot production, (4) Range and pasture management, and, Silviculture--(5) Silviculture and harvest management. The period of analysis was 1976-2010, and the emphasis was on the long-term future under moderate growth assumptions. This presentation summarized the findings of the EPA study including the ratings and rankings--by a national evaluation workshop--of environmentally-related trends within each of the five subsectors. Also, a further analysis of the various types of trends within the crop production subsectors was made to determine the relative importance of management practices--compared to input-use restraints and residual-output treatments--within the crop production system as a potential means of environmental pollution control in the future. (See also W79-09185) (Skogerboe-Colorado State)
W79-09195

BEST MANAGEMENT PRACTICES FOR FERTILIZER USE,
Fertilizer Inst., Washington, DC.
W. C. White, and H. Plate.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 133-141, 1979. 3 tab, 9 ref.

Descriptors: *Nutrient removal, Nutrient requirements, *Fertilizers, Environmental sanitation, Management, Application methods, Timing, Water quality control, *Farm practices.

A few examples were presented to illustrate the wide range of factors to consider in controlling nutrient levels in soils as to maximize plant recovery and to minimize loss to the environment. Even with the best available matrix mathematics, all individual factors cannot be quantitatively evaluated for every single eventual possible field condition. The judgement of the farmer must come into play in exercising Best Management Practices (BMP's) for nutrient use in crop production. It was suggested that the following four BMP's for plant-nutrient use deserve special attention: (1) matching rate of application closely to the need of each soil-crop combination, (2) time of fertilizer application, (3) method of application, and (4) forms of nutrients relative to crop recovery and loss to the

environment. (See also W79-09185) (Skogerboe-Colorado State)
W79-09196

BEST MANAGEMENT PRACTICES FOR SILVICULTURE,
Weyerhaeuser Co., Tacoma, WA.
W. C. Harper.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 263-270, 1979.

Descriptors: Forest management, Forest watersheds, Water quality control, Water pollution control, Water quality act, Pollution abatement, *Forest practices.

The silvicultural aspects related to Section 208 planning of Public Law 92-500 were addressed to ensure that the resulting plan is compatible with long-term forest management objectives. It was suggested that alternative management practices are developed for each site to allow land managers to select among an appropriate range of acceptable management practices. It was also suggested that an assessment of the effectiveness of Best Management Practices in meeting land management goals, including both water quality and timber production, must be conducted following implementation of the 208 plan. (See also W79-09185) (Skogerboe-Colorado State)
W79-09203

ESTIMATING IMPACTS OF SILVICULTURAL MANAGEMENT PRACTICES ON FOREST ECOSYSTEMS,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.
F. R. Larson, P. F. Ffolliott, W. O. Rasmussen, and D. R. Carder.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 281-294, 1979. 19 ref.

Descriptors: Forest management, Forestry, *Ecosystems, Computer models, Simulation analysis, *Land use, Planning, Streamflow, *Forest practices.

A family of computer simulation modules was described that would aid forest managers and land use planners estimate the impact of management activities on the natural resources of the forst ecosystem. This family, called ECOSIM, includes three general modules: FLORA for estimating responses of the forest overstory, herbaceous understory, and organic matter; FAUNA for evaluating animal habitats, carrying capacity, and population dynamics; and WATER for assessing streamflow yield, sedimentation, and chemical quality. A command system enables users to operate all modules through a common language written in straightforward user terminology. The design gives flexibility in representing management activities by operating selected modules interactively on an appropriate data base. (See also W79-09185) (Skogerboe-Colorado State)
W79-09205

DEVELOPMENT OF BMPS FOR AGRICULTURE-NEW YORK STATE STRATEGY,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
P. D. Robillard, M. F. Walter, and R. Gilmour.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 581-595, 1979. 7 fig, 7 tab, 6 ref.

Descriptors: *Water quality control, Water pollution control, Water management(Applied), Soil conservation, *Farm management, Planning, *New York, Sediment control, Farm practices.

The identification of specific problems, knowledge of the cause-effect relationships, direct installation costs and expected changes in farm income circumvent the choice of appropriate BMP's and their potential water quality benefits. How these concepts might be incorporated into a BMP development program for New York State was reviewed. Associated stages of BMP development and implementation techniques were proposed. Examples of this methodology were presented for two case study dairy farms. Candidate management practices were judged qualitatively and quantitatively in reducing potential soil, plant nutrient and manurial organic matter losses from cropland. Estimated changes in farm income were calculated for each measure. The risk in adopting new farm management measures and technology were considered in this BMP selection process. The potential for integrating soil erosion, agronomic recommendations and farm management concepts into the water quality elements of conservation farm plans was found to be good. Examples of this approach were presented. (See also W79-09185) (Skogerboe-Colorado State)
W79-09224

WATER POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09320

ENFORCEMENT OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 TO CONTROL NONPOINT SOURCE POLLUTION,
For primary bibliographic entry see Field 6E.
W79-09330

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ESTIMATING IMPACTS OF SILVICULTURAL MANAGEMENT PRACTICES ON FOREST ECOSYSTEMS,
Rocky Mountain Forest and Range Experiment Station, Flagstaff, AZ.
For primary bibliographic entry see Field 5G.
W79-09205

SIMULATION OF STORMWATER RUNOFF AND SEDIMENT YIELD FOR ASSESSING THE IMPACT OF SILVICULTURE PRACTICES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W79-09206

METHODOLOGY FOR DETERMINING THE OPTIMAL MIX OF BMP'S AND AGRICULTURAL PRODUCTION MODIFICATIONS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
J. P. Heaney, and D. C. Ammon.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 649-664, 1979. 17 fig, 1 tab, 11 ref.

Descriptors: Pollution abatement, Pollutants, Detention reservoirs, Sediment control, Linear programming, *Model studies, Sediment discharge, Dairy industry, *Farm practices, Farm wastes.

A simple procedure for determining the optimal mix of upstream and downstream controls in an urban area was presented by Heaney and Nix (EPA-600/2-77-083, 1977). This procedure was extended to permit evaluation of agricultural areas. The main difference between urban and agricultural problems is that the farmer may consider production modifications in response to an imposed restriction on pollutant discharge. A linear programming model was developed earlier by other research workers which allows one to determine the production adjustments that could be made on a dairy farm facing nutrient limitations. This model was coupled with information on Best Management Practices' effectiveness presented in another publication and was extended to evaluate waste management problems. (See also W79-09185) (Skogerboe-Colorado State)
W79-09227

INTERNATIONAL SYMPOSIUM ON LOGISTICS AND BENEFITS OF USING MATHEMATICAL MODELS OF HYDROLOGIC AND WATER RESOURCE SYSTEMS,
Preprints of Symposium held at Universita di Pisa, Italy, 24-26 October 1978. Convened by the International Institute for Applied Systems Analysis, Laxenburg, Austria, & co-sponsored by World Meteorological Organization, IBM Centro Scientifico, 1978. 584 p, 113 fig, 44 tab, 110 equ, 160 ref.

Descriptors: *Logistics, *Benefits, *Mathematical models, *Hydrologic systems, *Water resources, *Simulation analysis, *Computer programs, *Forecasting, *Water management(Applied), Optimization, Computer models, Floods, Decision making, Rivers, Planning, Costs, *Analytical techniques, Systems analysis.

Mathematical models are widely used for the simulation, analysis, and control of hydrologic and water resource systems. Although many of these models have been in use for several years and have been described at a number of conferences in terms of their basic structure and mathematical formulation, an exchange of experience in the operational aspects and logistics of these models occurs very rarely; this Symposium's purposes was to produce an exchange of ideas, knowledge and experience in this area of hydrologic and water resources modeling. The emphasis is on model implementation and use, including questions of logistics such as computer requirements and support staff, data needs and the cost-benefit of models in practical work. The proceedings is divided into four sections: (1) on-line simulation in hydrology, including flood, flow and runoff forecasting: (2) non-real-time simulation in hydrology; (3) simulation of water resources systems, considering planning and management problems; and (4) suites of programmes. Represented are numerous analytical techniques for simulation and optimization. (See W79-09286 thru W79-09313) (Bell-Graf--Cornell)
W79-09285

THE THAMES BASIN WATER RESOURCES MODEL,
Thames Water Authority, London (England).
J. R. Sexton.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 15 p, 6 fig.

Descriptors: *Water resources, *Simulation analysis, *Computer models, *Model studies, *Thames River basin(England), Water demand, Water supply, Computer programs, Aquifers, Digital computers, Effects, Hydrology, Rainfall, Management, Systems analysis.

In order to improve the evaluation of Thames Water's existing water resources and to assist in rolling forward the strategy to meet the anticipated growth in demand, a simulation model of the water resource system has been built. It is essential that consideration be given to the whole river basin when an enhancement to the system is being planned. This paper discusses the construction and use of the Thames Basin Water Resources Model. Designed first was the existing water conservation system. The physical system was defined in terms of components such as rivers, aquifers, reservoirs, demand centers, abstraction points, and effluent returns. Given herein is the model philosophy; discussed is the unconfined aquifer module, model input and output, system performance, and future plans for the model. The complexity of a typical modern water resource system is demonstrated. The use of simulation techniques on modern digital computers makes it possible to analyze these complex interactions to give a sounder base for understanding and predicting the water cycle in both

quantity and quality. (See also W79-09285) (Bell-Graf--Cornell)
W79-09300

LONG TERM RESOURCES ALLOCATION FOR CONTROL PURPOSES IN A WATER MANAGEMENT SYSTEM,
Institute of Meteorology and Water Management, Warsaw (Poland).
Z. Kaczmarek, K. Malinowski, and K. Salewicz.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis, Laxenburg, Austria. 23 p, 3 fig, 32 equ, 9 ref.

Descriptors: *Resource allocation, *Long-term planning, *Water management(Applied), *Optimization, *Algorithms, *Decision making, *Decentralized decision structure, *Price coordination, Hierarchical, Interaction balance method, Computers, Constraints, Rivers, Reservoirs, Water demand, Mathematical models, Equations, Systems analysis, Decomposition techniques, Control.

In Poland, it has become important to consider complex water management systems directed towards the efficient use of limited water resources in the face of increasing demands, not to mention the maintenance of appropriate quality standards. Traditional methods being used presently have been developed to consider conflicting objectives. To derive a reasonable compromise between conflicting goals, one must repeatedly make use of the overall decision-making mechanisms using adequate models of water allocation in the considered region. The work reported herein utilizes the following decision-making structure: decentralized decision mechanisms with price coordination. Presented is how the water resource and quality management tasks expressed by a mathematical model can be adopted to one- or multi-computer decision-making structure by applying the price coordination for the overall long-horizon system optimization problem solving. Presented is a basic hierarchical optimization algorithm: the Interaction Balance Method. Presented also are the requirements the model poses on the data basis and information structure. Discussed are the possible applications in the operational control structures designed to maintain appropriate quantity and quality standards. Finally, the practical adaptation of the model to this decision structure is shown and the computational and informational aspects discussed. (See also W79-09285) (Bell-Graf--Cornell)
W79-09302

DEVELOPMENTAL AND OPERATIONAL ASPECTS OF GAMING-SIMULATIONS FOR WATER RESOURCE SYSTEMS,
Water Resources Commission, Sydney (Australia).
G. L. Wright.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Reprint at Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 7 p, 5 ref.

Descriptors: *Gaming, *Simulation analysis, *Water resources development, Computer programs, Benefits, Decision making, Costs, Computer models, Systems analysis.

When designing large and complex water resource systems, one will almost certainly encounter conflicting goals. Gaming-simulation has become an accepted method of modeling environmental systems where conflicts and competition for a limited resource play a vital role. This approach amounts to an enlargement of the boundaries of the system being modeled beyond the physical and purely economic systems to include human decision makers. This paper outlines the developmental and operational problems likely to occur during the application of the gaming-simulation approach to the modeling of a water resource system. Also, requirements, in terms of manpower and computing facilities, for its implementation are discussed. The Water Resources Allocation Game (WRAG), which was developed to examine the problem of allocating a stochastic supply of water among competing users in the Upper Hunter Valley of New South Wales, Australia, is discussed as an example of a complex gaming-simulation. It is found that development and operation costs associated with a gaming-simulation are significantly higher than for a conventional all-computer simulation of similar complexity. However, where a simulation is to be developed to solve problems or plan the development of a water resource system in which conflicts occur between parties having interests in the planning and management of the available water and land resources, the benefits derived from a gaming-simulation may far outweigh the additional costs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09303

LOGISTICS OF LARGE-SCALE WATER RESOURCES MODELING FOR IRRIGATION PLANNING,
Hydrotechnic Corp., Madrid (Spain).
H. S. Nelson, P. Savasdibutr, R. K. Thomas, and D. P. Loucks.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis, (Laxenburg, Austria). 16 p, 2 fig, 1 ref.

Descriptors: *Water resources, *Land resources, *Optimization, *Agriculture, *Modeling approach, *Logistics, *Data analysis, *Food production, *Irrigation, *Planning, Water supply, Scarce water, Computer models, Linear programming, Reliability, Equations, Yield, Computer programs, Projects, Constraints, Benefit maximization, Cost minimization, Systems analysis.

Hydrotechnic and its consulting specialists have developed modeling techniques for national or regional water resources and agricultural planning, the goal being to produce an optimum water resource infrastructure to enable achievement of the highest degree of food production. Current national markets compete for scarce food supplies at increasing international prices, and countries see the need for achieving the utmost self-sufficiency in producing agriculture-based food. Required is increased development and more efficient utilization of national resources. Over the past decade, a computerized modeling approach to water resource and agricultural planning has been developed and successfully applied in a number of countries. This paper reviews some of the experiences in applying this approach to classify national resources and evaluate potential irrigable areas according to varying soil productivity levels for large numbers of different crops within the constraints of climate, characteristics of soils, water quantity, reliability and quality, labor availability and farming methods employed, required processing facilities, and marketing considerations. Discussed are optimization techniques, using cost minimization and benefit maximization. It is shown that model outputs were in a flexible form that identified both short- and long-term decisions. After developing an adequate national data base, a computerized multi-disciplinary approach was used to examine a wide range of development options and objectives, thus permitting national level decision makers to make well-informed choices given various political and socioeconomic constraints. (See also W79-09285) (Bell-Graf--Cornell)
W79-09304

MODEL FOR THE SELECTION OF APPROPRIATE TECHNOLOGY FOR A WATER RESOURCES SYSTEM,
Oklahoma Univ., Norman.
G. W. Reid.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 18 p, 4 fig, 11 ref.

Descriptors: *Water resources, *Technology transfer, *Process selection model, *Developing countries, *Water supply, Water pollution control, Waste water treatment, Waste disposal, Decision making, Systems analysis, Mathematical models.

Despite great efforts to improve the quality and quantity of water supplies in developing countries (LDC's), populations have increased faster than new facilities can be installed. The approach presented herein to aid in resolving this problem is: (1) to assist the LDC in using a system approach and in identifying the major alternatives; (2) to devise ways to present the alternatives to LDC decision makers, this facilitating diffusion; and (3) to assist LDC's in developing self-fufficiency in the selection or producing of appropriate technology. In 1973, a study was undertaken to develop a model to select appropriate (low cost) treatment methods for specific LDC sites. The model methodology has been tested for user and consumer acceptance, and methods are now being sought to implent its use. Discussed herein are the problem of the environmental setting, technology transfer, and the process selection model; dealt with is the dual problem of user acceptance of modeling and appropriate technology. Explored are the client/donar/modeler relationship and possible proactive and reactive programs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09305

MATHEMATICAL MODELS OF WATER RESOURCE SYSTEMS. SOME RECENT REALIZATIONS AT THE 'CASSA PER IL MEZZOGIORNO,'
Cassa per il Mezzogiorno (Italy).
F. Fabi, and G. Simonelli.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 51 p, 4 fig, 14 tab, 3 append.

Descriptors: *Water resources, *Mathematical models, *Simulation analysis, *Optimization, *River systems, Dams, Reservoirs, Constraints, Computer programs, Linear programming, Systems analysis.

For about eight years, the EDP Centre of the Cassa per il Mezzogiorno has studied and implemented automatic procedures for the analysis of water resource systems by means of mathematical models, this approach made possible by the availability of systematic hydrological data. The methods used are simulation and optimization. In applying both these techniques, different conceptual and operational problems have been faced and solved. Simulation techniques have been developed last, realizing a generalized interactive procedure (input loading - computation - output displaying) using APL Language. Its main characteristic is an 'end user' orientation, which results in a quick and easy management. Water systems can be described in very fine detail; several options are also allowed, both in I/O and operation. Optimization is applied using a linear programming package (MPSX) as a core of a procedure allowing: a quick fitting to different systems; an automatic processing of input data for all the different LP problems involved in the systems analysis; and an automatic reorganization of the solution according to the needs of both analysis and presentation of results. Emphasis has been put on the solution of decision problems more than on the research of comprehensive and sophisticated mathematical patterns and algorithms. The paper deals with applications of these methods to concrete decision problems faced during the last few years and shows an example of conjunctive use of simulation and optimization. (See also W79-09285) (Bell-Graf--Cornell)
W79-09307

MATHEMATICAL MODEL OF THE UPPER NILE BASIN,

World Meteorological Organization, Geneva (Switzerland). Dept. of Hydrology and Water Resources.
J. Nemec, and G. W. Kite.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 16 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Upper Nile Basin(Africa), *Lakes, *Computer models, *Computer programs, *Simulation analysis, *Logistics, *Constraints, Projects, Rivers, Catchments, Systems analysis.

The importance of logistics in modeling water resource systems is stressed. Described is the Hydromet Project, originated in 1967 as a cooperative venture between five African nations with the World Meteorological Organization as executing agency for the UN Development Program. After completing the first phase--collection and analysis of hydrologic and meteorologic data from lake catchments--a second phase aimed at developing a mathematical model to investigate alternative regulation patterns for the lakes to increase benefits to the riparian countries. Described is the computer model of the Upper Nile basin, which simulates the hydraulics of the River Nile, its lakes, and its tributaries. Discussed are: the catchment, lake and channel components; the master program; uses of the model; logistics of computer operation; constraints on model selection and building, including financial, data, location, hardware, and degree of sophistication constraints; and model benefits. The report contains a diagram of the model, an information flow diagram of the Upper Nile basin model, and a tabular outline of the computer programs. (See also W79-09285) (Bell-Graf--Cornell)
W79-09309

LOGISTICS AND BENEFITS OF THE EUROPEAN HYDROLOGIC SYSTEM,
International Inst. for Hydraulic and Environmental Engineering, Delft (Netherlands).
M. B. Abbott, R. Clarke, and A. Preissmann.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 39 p, 3 fig, 5 ref.

Descriptors: *Logistics, *Benefits, *Computer models, *Water resources, *Hydrology, Simulation analysis, Investment, Costs, Industrial water, Water allocation(Policy), Water pollution, Water treatment, Reuse, Recycling, Thermal powerplants, Waste disposal, Agriculture, Water balance, Land use, Domestic water, Water supply, Flood control, Droughts, Navigation, Legislation, Systems analysis, Data requirements, Hydropower, Toxic wastes.

During the past 20 years, computer-based hydrologic models have been transformed from subjects of academic research into tools of engineering practice, taking on strategic importance in laboratories and institutes. This paper describes The European Hydrologic System (SHE), a most ambitious and demanding project. The production system should be available around 1980 and will be able to generate models capable of fulfilling a large part of the demands of engineering practice. Herein we find sections discussing: (1) the origins of SHE; (2) a description of SHE, including two schematic diagrams of its structure and of mass flow through the model; (3) system investment and cost; (4) data requirements; and (5) system application and benefits. The fifth section considers: (1) industrial water use, including pollution treatment and costing, reuse, and hydropower generation; (2) agricultural water use, including water balance of rainfed and of irrigated agriculture; (3) domestic water use, including changes in waste water disposal and supply sources, setting targets, and allocating funds; (4) flooding and flood management; (5) drought and drought loss management; (6) inland navigation; (7) legislation and litigation; and finally (8) quantification. It is expected that the use of SHE will, in time, influence data collection programmes providing an incentive to new approaches and especially encouraging methods of satellite imagery. Development of SHE to its full capacity will depend upon the development of complementary data collection programmes and instrumentation. (See also W79-09285) (Bell-Graf--Cornell)
W79-09310

THE IMPLEMENTATION AND APPLICATION OF A SUITE FOR THE SIMULATION OF COMPLEX WATER RESOURCE SYSTEMS IN EVALUATION AND PLANNING STUDIES,
North West Water Authority, Warrington (England).
D. Pearson, and P. D. Walsh.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 38 p, 6 fig, 2 tab, 8 ref.

Descriptors: *Simulation analysis, *Water resources, *Computer programs, *Computer models, *Hydrologic aspects, Regions, Management, Hydrologic data, Data flow, Systems analysis, *Data base.

Described are the development, structure, scope and management of a suite of programs, and associated data base, developed by the North West Water Authority for an environmental and engineering appraisal of new water resource systems. The paper delineates the hydrological analyses carried out for the study and in particular discusses the arguments for a general as opposed to a specific simulation program. The organizational aspects are discussed with reference to the use of the suite in major and minor investigations by staff in decentralized locations and to the general and wider use of the suite within the Authority. (See also W79-09285) (Bell-Graf--Cornell)
W79-09311

EXPERIENCES OF THE HYDROLOGIC ENGINEERING CENTER IN MAINTAINING WIDELY USED HYDROLOGIC AND WATER RESOURCE COMPUTER MODELS,
Hydrologic Engineering Center, Davis, CA.
B. S. Eichert.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, October 24-26, 1978. Convened by International Institute for Applied Systems Analysis (Laxenburg, Austria). 14 p, 4 tab.

Descriptors: *Water resources, *Hydrology, *Computer programs, *Computer models, Costs, Manpower, Logistics.

The basic purpose of the Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers, Davis, California is to assist practicing engineers throughout the Corps in applying state-of-the-art technology to current planning, design and operation problems. This is accomplished by locating, evaluating and/or developing new modeling techniques, by teaching these in formal courses, by developing and maintaining a library of some 12 major state-of-the-art computer programs, and by assisting Corps offices in applying the techniques in current studies. This paper considers some of HEC's experiences in maintaining hydrologic and water resource computer models. Discussed are: major HEC programs; HEC cycle for computer program support, including research, documentation, training, user support, source deck distribution, and feedback; ways to encourage usage of the models; cost and manpower for program support; compatability with other computer systems; and implementing programs on other systems. The use of generalized models can be effective in accomplishing water resource studies if sufficient funds and manpower are provided to support the necessary functions described herein; information on manpower and costs provided may be useful in estimating the necessary logistic support required for similar support centers in other offices. (See also W79-09285) (Bell-Graf--Cornell)
W79-09313

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

6B. Evaluation Process

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitets vensen, Oslo.
For primary bibliographic entry see Field 2C.
W79-09152

PHYSICAL MODEL OF THE HYDROLOGY OF SLOPING HETEROGENEOUS FIELDS,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 2G.
W79-09161

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-09169

SOCIAL COSTS AND EFFECTIVENESS OF ALTERNATIVE NONPOINT POLLUTION CONTROL PRACTICES,
Economics, Statistics, and Cooperative Service, Ames, IA.
For primary bibliographic entry see Field 5B.
W79-09208

PROCEDURE FOR ECONOMIC EVALUATION OF BEST MANAGEMENT PRACTICES,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 4D.
W79-09213

AN ECONOMIC ANALYSIS OF EROSION CONTROL OPTIONS IN TEXAS,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4D.
W79-09214

WATER QUALITY MODELING IN THE DELAWARE COASTAL PLAIN REGION,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W79-09220

EVALUATION OF CONTROLS FOR AGRICULTURAL NONPOINT SOURCE POLLUTION,
Meta Systems, Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W79-09225

MATHEMATICAL MODELING OF WATER QUALITY EFFECTS OF AGRICULTURAL BEST MANAGEMENT PRACTICES,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5B.
W79-09226

MODELING NUTRIENT EXPORT IN RAINFALL AND SNOWMELT RUNOFF,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5B.
W79-09228

MODELING SOIL AND WATER CONSERVATION PRACTICES,
Hydrocomp, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5B.
W79-09229

INTERACTIVE EFFECTS OF PESTICIDE PROPERTIES AND SELECTED CONSERVATION PRACTICES ON RUNOFF LOSSES: A SIMULATION STUDY,
Environmental Research Lab., Athens, GA. Technology Development and Applications Branch.
For primary bibliographic entry see Field 5B.
W79-09230

6D. Water Demand

FINAL REPORT OF THE GOVERNOR'S TASK FORCE ON WATER RESOURCES,
Kansas Water Resources Board, Topeka.
December 1978. 69 p, 15 photo, 1 append.

Descriptors: *Kansas, *Water resources, *State governments, Water supply, Governments, Groundwater, Groundwater resources, Water resources development, Water quality, Surface water, Environment.

Kansas has major water problems, and a crisis is on the horizon. The declining underground water supply of the western third of Kansas threatens the agricultural economy of the entire state. Some cities are experiencing severe difficulties with their supply and delivery systems, and new demands are confronting other communities, to say nothing about pollution troubles. Water problems in Kansas are as diverse as they are complex, and they defy artificial political boundaries. Affirmative action was taken this past year on 16 of the 19 recommendations in the Task Force's 1977 Interim Report. Similar acceptance of the 20 recommendations contained in this Final Report is desired. Combined, the two reports provide some much needed background information about Kansas water, the state's water management structure, and existing problem areas. A common thread in the recommendations is the repeated emphasis on water conservation, water purity and water management coordination. A brief summary of action taken on the recommendations listed in the Interim Report was presented. Additional comments on some of these recommendations and followup actions appeared as indicated under appropriate chapter headings in the Final Report. (See also W79-02700) (Froehlich-ISWS)
W79-09137

EVOLVING WATER LAW NEEDS FOR THE SOUTHEAST US,
North Carolina State Univ., Raleigh. Water Resources Research Inst.
For primary bibliographic entry see Field 6E.
W79-09166

PENNSYLVANIA WATER LAW-REFORM IN PROGRESS,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 6E.
W79-09168

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
For primary bibliographic entry see Field 6E.
W79-09175

CONSERVATION ECONOMICS OF HAWAII'S SYSTEM OF WATER RIGHTS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W79-09182

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

6E. Water Law and Institutions

FINAL REPORT OF THE GOVERNOR'S TASK FORCE ON WATER RESOURCES,
Kansas Water Resources Board, Topeka.
For primary bibliographic entry see Field 6D.
W79-09137

EVOLVING WATER LAW NEEDS FOR THE SOUTHEAST US,
North Carolina State Univ., Raleigh. Water Resources Research Inst.
N. S. Grigg, D. H. Howells, W. E. Cox, and W. R. Walker.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division, July 26-28, 1978, Roanoke, VA. American Society of Civil Engineers, New York, N.Y., p 21-27, 1979. 10 ref.

Descriptors: *Water law, *Southeast US, *Water management(Applied), Saline water, Intrustion, Land use, Riparian rights, Surface waters, Groundwaters, Public access, Inter-basin transfer, Shore protection, Reservoir sites.

The current status of water law needs in the Southeast is presented. A background for future evaluation of these needs on a state-by-state and regional basis is provided. Despite no new research results, a basis for future research into water law issues is presented. A brief discussion of some of the issues identified by the states and how each state has modified their water law is included. The need of the southeastern states for water law changes must be approached on an individual basis. Although these states have considerable water supplies, they must recognize that careful water management must be developed through appropriate water law and institutions. The riparian doctrine (in its pure form) has long proven inadequate in the Southeast. Modifications of the Doctrine were observed already in several states. The Southeastern states must ask themselves in the future whether their body of water laws are adequate to meet emerging needs. (Coffey-Florida)
W79-09166

DEVELOPMENT OF WATER LAW IN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg, VA.
W. E. Cox, and W. R. Walker.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 28-40, 1979.

Descriptors: *Virginia, *Water allocation(Policy), *Water courses(Legal aspects), *Groundwater, Administration, Adoption of practices, Water control, Water conservation, Water management(Applied), Water policy, Water resources, Water law.

Virginia water law has undergone considerable development in the past decade. The common law doctrines that traditionally served to allocate surface and groundwater have been supplemented by statutory controls. In addition to these supplemental controls, an administrative allocation system has replaced the common law system for allocation of groundwater in certain regions of the state. The existing allocation mechanisms for groundwater under the Ground Water Act of 1973, and natural water courses management are discussed. There are several deficiencies that should be remedied and additional issues that should be addressed as the state re-appraises its water allocation institutions. Much data from other states' experiences exist as to the feasibility and consequences of various water allocation institutions. Institutions must be adapted to a particular states' conditions but much can be gained from comparative analysis. Consideration of other states' experiences will allow Virginia to benefit from their mistakes in developing its water law. (Coffey-Florida)
W79-09167

PENNSYLVANIA WATER LAW-REFORM IN PROGRESS,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
R. T. Weston.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 41-51, 1979.

Descriptors: *Pennsylvania, *Water allocation(Policy), *Water control, Water management(Applied), Watershed management, Inter-basin transfer, Watershed(Basins), Water quality control, Water uses, Agricultural runoff, Mine drainage, Resource allocation.

Pennsylvania has no existing institutional approach capable of managing both its ground and surface water resources. Developed during a period of abundance, current laws and programs are not designed to deal with shortage conditions or allocate water among competing users. Water uses can be initiated without any review of consideration of whether adequate supplies will be available to sustain all diversions and instream uses within a watershed. A few of the important water law issues and options being considered by Pennsylvania through its comprehensive Water Quality Management Planning Program (COWAMP) are highlighted. COWAMP encompasses all elements of wastewater management including point and nonpoint sources of pollution, agricultural runoff, abandoned mine drainage, sludge disposal and ground-water quality. Its overall objective is to establish a cost-effective, long-range basis for water quality management in Pennsylvania. The major policy and program options are explored. Pennsylvania can no longer afford to muddle through the management of its valuable water resources. It is time to consider how Pennsylvania will wisely manage those resources in the interest of all its citizens. (Coffey-Florida)
W79-09168

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
C. F. Kiker, G. D. Lynne, and A. Starr.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 52-64, 1979. 24 ref.

Descriptors: *Administration, *Economic efficiency, *Florida, *Distribution systems, Water resources, Distribution, Alternative costs, Comparative costs, Comparative benefits, Common law, Water law.

Eastern common law water doctrines are based on the concept that water is a common property resource. Everyone has an entitlement to use with no specific private rights. Statutory modification of eastern water law doctrines to include administration is a response to the inadequacies of common law doctrines. The 1972 Florida Water Resources Act is an example of an administrative system. The relationship between the management authority and private water users is discussed. Specifically, questions of economic efficiency and distribution are posed. There are four sections: Section (1)

deals with the allocation basis of specific water quantities to private users under Florida's administrative system; Section (2) addresses alternative approaches to allocating private water entitlements. These alternatives are based on various aspects of water law and are evaluated from an economic perspective; Section (3) introduces a present study undertaking a quantitative evaluation of the alternative allocation approaches from an economic perspective; and Section (4) concludes there are several alternative approaches to assigning water entitlements feasible under eastern water law. Each has different economic impacts on water users. Without analysis, the magnitude of these impacts are indeterminable. Included are 24 references. (Coffey-Florida)
W79-09169

THE APPROPRIATE RIGHT AS COMMON LAW,
Nevada Univ., Reno.
J. W. Bird.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 81-87, 1979. 11 ref.

Descriptors: *Appropriation, *Common law, *Riparian rights, *Nevada, Water rights, Water law, Priorities, Control, Water management(Applied), Water distribution(Applied).

Problems of water rights, obligations and duties associated with water use generally belong to either of two classes: riparian and/or appropriative. The riparian right is typically referred to as a 'common law' right. The appropriative right is introduced or governed by statute. The need for this distinction in the western states generally and specifically in Nevada is questioned. The common law is subject to change. It may be possible to have a declaration by the courts that the appropriation doctrine is a part of the common law of the state. This would provide legal continuity for better control over the available water in the state. Portions of the appropriation statutes that have never been construed could be examined as a formalized or written segment of the common law and not as a separate entity from the common law. This would tend to clarify the entire appropriation picture. (Coffey-Florida)
W79-09170

RESERVED RIGHTS AND FEDERAL CLAIMS TO WATER,
Colorado State Univ., Fort Collins.
N. Wengert.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 93-107, 1979.

Descriptors: *Appropriation, *Public rights, *Forest management, *Federal-state water rights conflict, Prior appropriation, Priorities, Beneficial use, Water rights, Riparian rights, Water uses, Forest watersheds.

The Reserved Rights Doctrine (Doctrine) was developed and applied by the federal courts in the semi-arid western states. In this area, appropriation principles of water law are dominant, and the public domain and withdrawals from it by the federal government represent important aspects of land ownership and management. The potential conflict between the Doctrine which established federal water rights in the west and state principles of prior appropriation water rights is discussed. A summary is provided of the principles of western water law contrasted with eastern water law. The evolution of the appropriation doctrine is traced. A lengthy analysis of the federal reserved rights as clarified by case law is presented, special attention being to Arizona v. California, U.S. v. New Mexico (The Mimbres Opinion) and Colorado cases. The interests of the Forest Service in western management are also analyzed. The effect of the Mimbres opinion on the goal of forest management is examined. (Coffey-Florida)
W79-09171

WESTERN WATER LAW AND IRRIGATION RETURN FLOW,
Colorado State Univ., Fort Collins.
G. E. Radosevich, and G. V. Skogerboe.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE) Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1979, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 108-120, 1979.

Descriptors: *Irrigation operation and maintenance, *Irrigation effects, *Return flow, *Irrigation design, Water pollution sources, Irrigation, Irrigated land, Irrigation efficiency, Irrigation water, Water quality control, Agriculture.

Water pollution from irrigated agriculture in the west has recently received much attention. This is a result of federal and state endeavors to identify irrigation return flow quality problems and to develop a viable control strategy. Water quality control laws are recent, relatively uniform among states, and usually constrain improvement of return flows from irrigated agriculture. Water quantity control and management laws are complex, voluminous, inconsistent and lack uniformity among the 17 western states. The Influent Control Approach (ICA) is based upon the assumption that improved water management and agricultural practice, will significantly contribute to improved water quality. The ICA consists of eight components to be carried out by the states: (1) Designation of problem areas; (2) Development of standards and criteria for beneficial use; (3) Introduce incentives for more efficient water use; (4) Addition of water quality to water rights; (5) Adoption and enforcement of a reporting and recording system for water rights; (6) Recognition of reasonable degradation from agricultural water use; (7) Adoption of Agricultural Practices Act; and (8) Promotion of cooperation and integration of state water agencies. (Coffey-Florida)
W79-09172

LEGAL IMPLICATIONS OF INCREASING THE AVAILABILE WATER,
Blatchley Associates, Inc., Denver, CO.
V. P. Soicel, and R. K. Blatchley.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 121-129, 1979. 12 ref.

Descriptors: *Water yield improvements, *Water allocation(Policy), *Water utilization, *Water supply development, Political constraints, Water demand, Weather modification, Evaporation control, Appropriation, Hydrologic cycle, Water supply.

Western states have adopted a legal system of allocating a scarce water supply to those who have been first to apply the water to a beneficial use. The law has recognized both the limited supplies available and the need to efficiently utilize those resources. Every state prohibits water waste; yet, they forego opportunities to increase supplies while demand grows. Our legal system of allocating water needs revamping. The current water law and the potential for providing private incentives for developing greater supplies are analyzed. Determining the appropriate incentive for increasing available water supplies depends upon the developer's ability to quantify the increased supply and to protect vested rights. This means the continued use of the prior appropriation concept, but not continued piecemeal adjustments to the concept which promote complexity and confusion. A first step to simplifying the present appropriation system is to provide a scientific basis for the decision-making process. The most important aspects are understanding the hydrological cycle and where a particular proposal may affect that cycle. (Coffey-Florida)
W79-09173

INDIAN WATER RIGHTS: LAW AND REALITY,
S. Smith.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 131-137, 1979.

Descriptors: *Federal reservations, *Indian reservations, *Federal-state water rights conflicts, Federal jurisdiction, Agriculture, Irrigable land, Water users, Water supply, Water resources, Water rights.

The last 125 years have seen the isolation of Indians on reservations, usually on land considered undesirable for any other purpose when created. In 1908 the Supreme Court decided the Winters Case stating that Indian water rights are based on future needs not present uses. This case provided the legal basis for asserting the reservation Indians' water rights. The quantity of water reserved for Indians was at issue in Arizona v. California. The decided quantity became the lesser of one million acre-feet or the amount intended to satisfy the future as well as the present needs of the Indian Reservations so that enough water was reserved to irrigate all irrigable reservation acreage. This measure has become entrenched despite its ambiguity. The Winters decision presupposed no particular use while Arizona based the measure on agriculture alone. A quantum for other uses has never been set. Recent court decisions have increased the states' role in the determination of Indian/federal water rights. There should be Indian/federal and state negotiations to protect Indian water rights. (Coffey-Florida)
W79-09174

WATER RIGHTS AND WATER USE EFFICIENCY,
Colorado Univ., Boulder.
J. E. Flack.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 143-149, 1979. 10 ref.

Descriptors: *Water rights, *Water uses, *Efficiencies, *Water shortage, Wastes, Withdrawal, Conservation, Water supply, Basins, Waste water disposal, Water law.

Every modern American water law doctrine prohibits the waste of water. To make a beneficial use of withdrawn water, it is almost always necessary to divert more water than is actually needed at the place of use. The reduction in the withdrawal of these excess quantities is defined as conservation. By conserving water, savings can result. The capture of this saved water, and the entitlement to its use, is discussed. A brief analysis is presented of the case law as applied to increased water use efficiency and to entitlement to saved water. One who can show that he has actually increased the water supply above that naturally available may obtain title to that water regardless of other's rights. In those cases, where someone downstream has appropriated waste water, part of the natural supply of the basin where used there will be some question of entitlement to the water, especially in appropriation states. Some water is likely to be handled as part of the natural supply, with the

same priorities and allocation as that supply. (Coffey-Florida)
W79-09175

INTERRELATING LAND AND WATER MANAGEMENT IN FLORIDA,
F. E. Maloney, and R. G. Hamann.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 150-169, 1979.

Descriptors: *Florida, *Water management(Applied), *Land management, *Comprehensive planning, Land resources, Land development, Land use, Water law, Water policy, Water resources, Water utilization, Water districts.

Today there is general agreement that whatever is done with water will have some impact on what can be done with the land and vice-versa. Despite physical interrelationships and a consensus among knowledgeable persons that unity is needed, land and water planning and management have historically proceeded along separate paths. A surge of political activity by environmentalists led to the passage between 1972 and 1975 of several significant new laws in Florida that plan and regulate the impact of human activity on land and water resources. An extensive analysis is presented of the 1972 Environmental Land and Water Management Act, the 1972 Florida State Comprehensive Planning Act and the 1975 Local Government Comprehensive Planning Act. There is a need to develop a comprehensive, holistic approach to resource use. The key to attaining that goal is greater communication and cooperation among the agencies responsible in this area. (Coffey-Florida)
W79-09176

NAVIGABLE WATERWAYS: THE NEW HAMPSHIRE EXPERIENCE,
Environmental Assessment Council, Inc., New Brunswick, NJ.
M. J. Schiffman.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 179-192, 1979.

Descriptors: *Navigable waters, *New Hampshire, *Federal jurisdiction, *Federal-state water rights conflicts, Regulation, Federal government, Navigable rivers, Navigation, Administrative agencies, Coast guard regulations, Water rights.

In 1975 the Coast Guard declared 'the narrows' of New Hampshire's Lake Winnisquam navigable and subject to United States jurisdiction. This decision was based on a series of court decisions which gave rise to two concepts: (1) To be navigable, waterways need not be navigable in their natural state as long as reasonable improvements may create a feasible use for interstate commerce; and (2) once a waterway is navigable, that status is retained regardless of any construction which may deter practical commercial travel. The finding of navigability was also supported by the 1971 Federal Boat Safety Act designed to bring uniformity to boat registration and safety requirements. Prompted by fears of losing boat registration fees, reductions in police enforcement and waterway pollution, New Hampshire challenged the Coast Guard's finding. How the federal claim arose, developed and was subsequently dropped is examined. After examining the long history of court opinions from which the definition of navigability has evolved and after questioning its applicability today it is suggested that the term must be more clearly defined. (Vloedman-Florida)
W79-09177

WATER RESOURCES TECHNOLOGY AND WATER LAW,
Portland State Univ., OR.
R. E. Miller.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning of Civil Engineers, New York, N.Y., p 193-203, 1979.

Descriptors: *Water law, *Colorado, *Judicial decisions, *Technology, Water policy, Water resources, Administration, State governments, State jurisdiction, Engineering, Planning.

One major concern in effective water resource management is the interaction among economic, political and legal aspects of such management and the resource's technical setting. Two Colorado Supreme Court cases are analyzed in order to investigate and make recommendations regarding the entry into evidence of water resources technology. Six distinguishable ways by which technology may be admitted into evidence are discussed: (1) Expert and non-expert testimony; (2) Judicial notice; (3) special jury; (4) specialized courts; (5) court appointed masters and referees; and (6) administrative hearings. There are two types of problems associated with the water resources information the courts receive. First, the presentation of facts is often unsound, misleading, and incorrect. Often not detected by the trial court, these errors become part of the record and are used by the appellate courts since they take no new evidence. The second problem is that technological information is presented by attorneys who will use only that information supportive of their case. Therefore, information which would be in the public interest may not be presented. (Vloedman-Florida)
W79-09178

STATE WATER LAWS: EFFECT ON ENGINEERING SOLUTIONS,
Army Engineer District, Galveston, TX.
For primary bibliographic entry see Field 4A.
W79-09179

LEGAL IMPLICATION OF GROUND WATER QUALITY CONTROL,
California Univ., Davis.
O. Helweg, and W. Brooks.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of the 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 326-339, 1979. 10 ref.

Descriptors: *California, *Groundwater basins, *Water quality control, Lake basins, Inter-basin transfers, Groundwater, Pumping, Degradation(Decomposition), Drainage water, Water districts, Water management(Applied).

The problems of overpumping and groundwater degradation in the Tulare Lake Basin in the Central Valley of California are discussed along with some of the proposed solutions. Intra-basin transfers could reduce the need for imported water and decrease the size of the proposed drain to export drainage water of low quality out of the basin. There are major legal and institutional obstacles to a basin-wide management scheme. California has little or no formal groundwater law. There are three main approaches to manage the basin: (1) the 'do nothing' approach in which the groundwater would continue to degrade and water levels would continue to fall, until the pumping became uneconomical and/or the groundwater became too saline to use; (2) established pumping limits through court action, which is very expensive and time consuming; and (3) formation of an overall water district or confederation of districts. This is also complex because of the great number of existing districts and the lack of committment to a basin-wide solution. Presently, all of these alternatives are being investigated. Maps and diagrams are included. (Coffey-Florida)
W79-09180

GROUNDWATER MANAGEMENT IN NEBRASKA,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
J. D. Aiken, and R. J. Supalia.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 484-98, 1979. 10 ref.

Descriptors: *Nebraska, *Groundwater resources, *Water management(Applied), Groundwater availability, Irrigation, Irrigation effects, Irrigation water, Well regulations, Well spacing, Water allocation(Policy), Local governments.

Historically, Nebraska had permitted unlimited groundwater development subject only to ineffectual local groundwater control. Since the 1976 Ground Water Management Act (GWMA) was passed, Nebraska has been the most active of the major groundwater-using states in pursuing effective local groundwater control. The GWMA's potential effectiveness as a ground water control mechanism is evaluated. The various groundwater control authorities created by the GWMA and their collective management of declining groundwater levels associated with irrigation are assessed. The GWMA appears to be an effective mechanism for managing declining groundwater levels, and a model which states interested in groundwater control should consider. Because it represents a first step toward total groundwater management, the GWMA has some limitations. In spite of these limitations, the GWMA represents a significant step in ground water management policy. (Coffey-Florida)
W79-09181

CONSERVATION ECONOMICS OF HAWAII'S SYSTEM OF WATER RIGHTS,
Hawaii Univ., Honolulu. Water Resources Research Center.
H. Yamanchi.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 499-510, 1979.

Descriptors: *Hawaii, *Water distribution(Applied), *Conservation, *Economic efficiency, Water, Water conservation, Water policy, Water rights, Water supply, Water users, Water demand, Water resources.

The problems of conserving and allocating scarce water resources among competing users and uses in Hawaii have been compounded by legal and economic uncertainties. Hawaii's system of water rights has been labeled unique. It has evolved from ancient customs and does not clearly fit within the riparian-appropriation schemes of other mainland states. Two important results of this unique evolution have been the preservation of a strong private property orientation for water resources and a relatively undeveloped governmental framework for controlling decisions at the operating level. Maximum security and flexibility to private owners do not necessarily assure responsiveness of the system to conservation in the public's interest. Institutional innovations are the key to improving water resources conservation and management in Hawaii. Ambiguities in water rights are being tested in the courts. Attention has been directed to the original common Hawaiian property concept. Ownership, usership and transfer are basic tenure concepts which need clarification for furthering the reasonable beneficial use principle. Anchoring this broad and flexible principle in state water policy can serve as the basis for modernizing water regulations and administration in Hawaii. (Ewing-Florida)

W79-09182

BYZANTINE DRAINAGE LAW: PENNSYLVANIA'S EXPERIENCE,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
R. T. Weston.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 637-646, 1979.

Descriptors: *Pennsylvania, *Stormwater, *Flood control, *Drainage, Storms, Water policy, Flood damage, Flood water, Drainage practices, Drainage programs, Legal aspects, Water law.

Pennsylvania has abundant water resources. This bounty has at times also been the scourge of Pennsylvania's citizens. Flooding has damaged human settlements from the earliest days of the colonial proprietors. Increasingly, the costs of uncontrolled drainage modifications and stormwater management have fallen on the State and Federal budgets through damage to public facilities, flood relief to injured communities, and revenues lost through unemployment and tax adjustments to damaged properties and businesses. Much of Pennsylvania's stormwater management and flooding problem can be traced to Byzantine common law drainage rights doctrine. A number of statutory and administrative programs also affect the stormwater picture. The goals of future stormwater policy include: (1) a more coordinated approach to stormwater maintenance; (2) prior planning; (3) conservation of natural drainage characteristics; (4) addressing stormwater problems on a watershed basis; (5) flexibility and certainty in drainage rules; (6) compatibility with other water resource and environmental objectives; (7) stormwater management as an integral part of land use planning and development programs; and (8) future programs which are administered and implemented through realistic manpower and budgetary resources. (Ewing-Florida)
W79-09183

LEGAL PROBLEMS OF STORMWATER POLLUTION ABATEMENT,
Spessard L. Holland Law Center, Gainesville, FL.
B. D. E. Canter.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management: Proceedings of 1978 Specialty Conference (ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division), July 26-28, 1978, Roanoke, Va., American Society of Civil Engineers, New York, N.Y., p 660-667, 1979.

Descriptors: *Storm water, *Pollution abatement, *Storm runoff, *Florida, Federal water pollution control act, Legal aspects, Political aspects, Political constraints, Runoff, Riparian rights, Legislation, Design standards, Performance, Land management.

Legal problems with stormwater runoff abatement (SRA) arise from the nature of runoff itself. As a nonpoint pollution source, SRA is difficult to quantify and evaluate. Control programs are hard to develop and subsequently defend in the courts when challenged. Section 208 of the Federal Water Pollution Control Act mandated that something be done about SRA and other major nonpoint pollution sources. Inadequate funding and a lack of political support for control programs have become formidable obstacles for the agencies responsible for water quality management planning. The requisite authority already exists in most states to begin abating SRA pollution. The regulatory agencies must now begin to utilize that authority to implement sound and comprehensive SRA programs. Utilization of Best Management Practices and design and performance standards will be the new methodology for controlling nonpoint source pollution. These presage increased land use restrictions. Careful and extensive data collection will be the key to defending the reasonableness of any SRA control program. (Coffey-Florida)
W79-09184

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE, PROCEEDINGS, 1978 CORNELL AGRICULTURAL WASTE MANAGEMENT CONFERENCE.
For primary bibliographic entry see Field 5G.
W79-09185

NONPOINT SOURCE POLLUTION CONTROL STRATEGY,
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5B.
W79-09186

RESEARCH NEEDS AND CURRENT ACTIVITIES,
Environmental Protection Agency, Washington, DC. Office of Research and Development.
For primary bibliographic entry see Field 5G.
W79-09189

BEST MANAGEMENT PRACTICES FOR AGRICULTURE AND SILVICULTURE: AN INTEGRATED OVERVIEW,
Environmental Research Lab., Athens, GA.
For primary bibliographic entry see Field 5B.
W79-09190

CONSERVATION DISTRICT INVOLVEMENT IN 208 NONPOINT SOURCE IMPLEMENTATION,
National Association of Conservation Districts, Washington, DC.
For primary bibliographic entry see Field 5B.
W79-09191

BEST MANAGEMENT PRACTICES FOR SILVICULTURE,
Weyerhaeuser Co., Tacoma, WA.
For primary bibliographic entry see Field 5G.
W79-09203

MANAGEMENT AND FINANCING OF AGRICULTURAL BMPS,
URS Co., Seattle, WA.
J. M. Rice.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 329-340, 1979. 2 fig, 1 tab, 3 ref.

Descriptors: Water quality control, *Planning, Management, *Agricultural runoff, *Water pollution sources, Water pollution control, Programs, Nonpoint sources, Farm practices.

One of the major goals of the Section 208 areawide waste management planning program, mandated by PL 92-500 and administered by the U.S. Environmental Protection Agency (EPA), is to develop solutions to identified water pollution problems which can and will be put into practice. The agricultural program developed in SNOMET/King County (Wshington) represents one approach to implementing nonpoint water pollution control measures which both satisfies the technical and other requirements of EPA concerning water quality management and satisfies the more pragmatic requirements of working farmers who are concerned both about making a living and about conservation. This paper presented the results of that program with special emphasis on unique aspects of the social and political setting of the SNOMET/King County area. The implemented program is in one sense no different than those developed in many other agricultural areas of the country; yet its acceptance by the local farming community and their willingness to participate in implementation of the program represent an institutional achievement in itself. Process, not product, then was a major focus of this paper. (See also W79-09185) (Skogerboe-Colorado State)
W79-09209

THE POLICY RELEVANCE OF ALTERNATIVE INSTITUTIONAL APPROACHES TO 208 PLANNING,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
A. Hamilton, and L. W. Libby.
In: Best Management Practices for Agriculture and Silviculture, Proceedings of the 1978 Cornell Agricultural Waste Management Conference, p 419-428, 1979. 4 tab, 3 ref.

Descriptors: Water quality control, Water quality act, *Planning, Decision making, Alternative planning, Local governments, *Nonpoint sources, Farm practices.

The power to implement many of the best management practices to control nonpoint pollution being considered in 208 planning lies with local governments (county, city, town, village). But the planning for reduction of nonpoint sources of pollution is between coordination and implementation that occur at these two different institutional boundaries were examined. It was believed that this research will have relevance not only to the water quality planning process but to a number of other planning exercises as well. The paper has drawn preliminary conclusions on the policy relevance of the different planning models discussed. (See also W79-09185) (Skogerboe-Colorado State)
W79-09215

INSTITUTIONAL AND TECHNICAL ASPECTS OF THE DEVELOPMENT OF AGRICULTURAL BMPS IN A FIVE-COUNTY RURAL/URBAN MICHIGAN REGION,
Williams and Works, Inc., Grand Rapids, MI.
For primary bibliographic entry see Field 5B.
W79-09217

APPROACH FOR ANALYZING AND MANAGING AGRICULTURAL NONPOINT SOURCES IN THE STATE OF MARYLAND,
Maryland Dept. of Natural Resources, Annapolis. Water Resources Administration.
For primary bibliographic entry see Field 5B.
W79-09222

DEVELOPMENT OF A '208 PLAN' FOR AGRICULTURAL NONPOINT POLLUTION SOURCES IN ILLINOIS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W79-09223

ALTERNATIVES TO APPROPRIATION LAW,
Wyoming Univ., Laramie.
F. Trelease.
In: Water Needs for the Future, Nanda, V.P., ed., p 59-81., Westview Press, Boulder, Colorado, 1977.

Descriptors: *Appropriation, *Water allocation(Policy), *Economic justification, *Alternative planning, Economics, Economic efficiency, Administrative agencies, Administrative decisions, Permits, Environmental effects, Prior appropriation.

Recently, many water laws throughout the world have been subjected to review and reconsideration. A search is being made for new and modern forms of water law. Older systems of self-generating rights are to be discarded. In the search for a new system, the administrative allocation of water; is frequently advocated, although its meaning is not always clear. The major objective of any water law must be to achieve, or at least promote, the efficient allocation of water resources. Economic efficiency is the reference: that combination of labor, capital, and resources which will produce the greatest net benefits. Social and environmental factors will be worked into the cost-benefit analysis. State plans, programs, and policies may determine the optimum to be sought, and state projects

and agencies may contribute to reaching it. However, in most countries a very large contribution toward optimum use of water for irrigation and industry will come from private sources. The water law system must foster and encourage water use and provide a climate conducive to investment in water-using enterprises. (Coffey-Florida)
W79-09315

LEGAL RESTRAINTS AND RESPONSES TO THE ALLOCATION AND DISTRIBUTION OF WATER,
Denver Univ., CO.
M. D. White.
In: Water Needs for the Future, Nanda, V.P., ed., p 117-131, Westview Press, Boulder, Colorado, 1977.

Descriptors: *Water distribution(Applied), *Water control, *Water allocation(Policy), Water resources, Appropriation, Riparian rights, State government, Federal government, International waters, Surface waters, Underground streams.

The legal aspects of water allocation and distribution are governed by three variable factors: (1) the law being applied - which could be state, interstate, federal, or international; (2) the legal classification of the water involved-an artificial distinction between surface and underground stream waters on one hand and underground percolating water on the other; and (3) whether one is dealing with the initial allocation or a second generation allocation. An overview of these factors is presented including the following topics: (1) state law on stream water (the appropriation and riparian doctrines) and underground water; (2) interstate allocation and distribution; (3) federal law including navigation servitude, U.S. reserved rights, water pollution control, and federal projects; (4) international allocation; (5) problems of initial allocation in riparian and allocation jurisdictions and problems of second generation allocation; and (6) miscellaneous aspects of water resouce allocation and distribution, such as minimum stream flows, developed water, anti-export statutes, basin of origin protection, constitutional preferences, condemnation of water rights, and the relationship between water allocation and land use controls. (Coffey-Florida)
W79-09316

ALLOCATION AND MANAGEMENT OF INTERSTATE WATER RESOURCES: THE EMERGENCE OF THE FEDERAL-INTERSTATE COMPACT,
Devevoise and Liberman, Washington, DC.
J. C. Muys.
In: Water Needs for the Future, Nanda, V.P., ed., p 83-104, Westview Press, Boulder, Colorado, 1977, 1 app.

Descriptors: *Water allocation(Policy), *Interstate compacts, *Water management(Applied), Federal project policy, State governments, River basins, Water resources, Water pollution control, Flood control, Political aspects.

A mechanism was built into the United States Constitution to deal with interstate water problems. Article I, Section 10, Clause 3 provides for the continued use of interstate agreements or compacts, subject only to the requirement of Congressional consent to such agreements. A brief survey of the use of interstate compacts in the water resources field is presented. Water compacts (other than those relating to navigation and fishing) may be grouped into four categories relating generally to: (1) water allocation; (2) pollution control; (3) flood control and planning; and (4) comprehensive water regulation and project development programs, or the federal interstate compact. A Congressionally approved regional institutional arrangement is needed. This will mandate cooperative coordinated action by federal agencies in conformity with the views of the affected basin states, while necessarily reserving the federal government's right to assert the paramount national perogative in appropriate situations. Included is a two-page appendix which lists compacts relating to the planning and management of interstate water resources. (Coffey-Florida)
W79-09317

TRANSMOUNTAIN DIVERSIONS OF WATER IN COLORADO,
Moses, Wittemeyer, Harrison and Woodruff Boulder, CO.
R. J. Moses.
In: Water Needs for the Future, Nanda, V.P., ed., p 105-111, Westview Press, Boulder, Colorado, 1977.

Descriptors: *Colorado, *Water distribution(Applied), *Water requirements, *Water transfer, Water districts, Water importing, Water resources, Water supply development, Water allocation, Water users, Water supply.

Most of Colorado's internal water problems arise because Colorado is a rectangular state established without regard to river basin drainages. In Colorado, most of the people live east of the Continental Divide and most of the stream water runs on the west side of the Divide. The problems that have developed as a result of this situation and the solutions that have been evolving are analyzed. Originally, no legal obstacles barred transmountain water diversions designed to overcome the geographical quirks. Consequently, many private and public transmountain diversions were developed. In the 1930s, the trend away from wholesale transmountain diversions began. Now, the increased concern of western slope residents about the water supply inadequacies for western slope development will be a major obstacle to future major transmountain diversions. Increased environmental constraints pose an even greater threat to such diversions. The day of major transmountain diversions of water in Colorado has passed. It is unlikely that even those diversions on the drawing board for years will be built. (Coffey-Florida)
W79-09318

WATER RIGHTS ISSUE ANALYSIS - A REPORT TO THE GOVERNOR,
Washington State Dept. of Ecology, Olympia.
For primary bibliographic entry see Field 4A.
W79-09319

WATER POLLUTION,
I. Sloan.
In: Environment and the Law, p 19-30, Oceana Publications, Inc., Dobbs Ferry, New York 10522, 1979.

Descriptors: *Water pollution control, *Water pollution treatment, *Water pollution sources, *Water pollution effects, Water pollution, Water policy, Legislation, Water law, Wastes, Waste water(Pollution), Waste water treatment.

Until recently Americans have acted as though their rivers and lakes had an infinite capacity to absorb wastes. Pollution was considered the price of progress. Not until 1948 was comprehensive federal water pollution control legislation enacted. The first permanent legislation was not passed until 1956. The original overriding concern was with human health. Almost all state water pollution programs were carried out by State health departments. An in-depth historical analysis of the developing water pollution control effort by federal and state governments and an in-depth scientific analysis of the effects of water pollution and the results of wastes discharged into various water bodies are presented. Water pollution control legislation and programs have been broadened to encompass many environmental concerns, including recreation and aesthetics. Epidemics due to water borne causes are largely in the past. Our health efforts have moved to a more sophisticated concern for the effects of small amounts of toxic chemicals on humans and other life forms. (Coffey-Florida)
W79-09320

COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS (FINAL RULEMAKING).
Department of Energy, Washington, DC.
Federal Register, Vol. 44, No. 46, p 12594-99, March 7, 1979.

Descriptors: *Floodplains, *Wetlands, *Protection, *Flood protection, Federal government, Regulation, Flood control, Flood damage, Flood plain insurance, Floods, Water table.

These regulations are issued pursuant to Executive Orders 11988 and 11990. Under these orders each federal agency must issue regulations or amend existing regulations to ensure consideration of floodplain and wetland protection. The Department of Energy (DOE) will take the following actions to ensure such protection: (1) avoid the long and short-term adverse impacts associated with wetland destruction; (2) avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative; (3) incorporate floodplain management and wetlands protection goals into the decision-making processes. These goals would include: (a) reducing the risk of flood loss; (b) minimizing the flood impact on human safety, health, and welfare; (c) restoring and preserving natural and beneficial values; (d) minimizing wetland destruction, loss, or degradation; (e) informing private participation parties of the flood-related hazards involved in any financial transaction related to a floodplain area; (4) undertake an evaluation of the potential effects of any DOE action; (5) implement alternative action to avoid adverse impacts; and (6) provide an opportunity for early public review of any plans for actions in floodplaining and wetland areas. (Coffey-Florida)
W79-09321

THE LAW OF THE SEA AND OCEAN RESOURCES,
T. Ishimine.
American Journal of Economics and Sociology, Vol. 37, No. 2, p 129-44, April, 1978.

Descriptors: *Law of the sea, *Oceans, *Resources development, Resources, Resource allocation, Foods, Fish, Fishing, Economics, Navigation, Navigable waters.

Recently, the nations began to recognize the ocean as an important resource source. The ocean's immense potential for providing food and nutrition particularly protein, began to be reexamined. The ocean also contains a seed of conflict among nations, because of overlapping claims to ocean resources. Attempts to establish the law of the sea have failed to reach an accord as to the definition of territorial waters and economic zones. At stake are freedom of navigation, fishing rights, and claims over mining deep seabed resources. The possible outcome of the law of the sea and ocean resources is examined to avoid scrambles among nations over the ocean resources. An in depth analysis is presented of the beginnings of this developing area of conflict in international law. Suggestions of the course to be followed and the considerations involved are discussed. (Coffey-Florida)
W79-09322

SETTLEMENT OF FISHERIES DISPUTES IN THE EXCLUSIVE ECONOMIC ZONE,
S. Rosenne.
American Journal of International Law, Vol. 73, No. 1, p 89-104, January, 1979.

Descriptors: *Law of the sea, *United nations, *Coasts, *International law, Resources, Resource allocation, Fisheries, International waters, Water law, Jurisdiction.

The question of the settlement of disputes as to the exercise of sovereign rights by a coastal state over the living resources of the exclusive economic zone is described as it evolved during the seventh session of the Third United Nations Conference on the Law of the Sea (UNCLOS III). Many important powers insist that the new convention contain adequate provisions for third-party settlement of disputes. During its first six sessions, UNCLOS III was concerned with establishing machinery for compulsory settlement of disputes arising under the new convention. Questions as to the attribution

of jurisdiction to that machinery were left for later consideration, after the outlines of the new substantive law of the sea became clearer. Article 296 of the Informal Composite Negotiating Text set forth limitations on the applicability of the compulsory dispute settlement provision. Out of session seven evolved a new formulation of article 296, intended to provide safeguards against another state's abuse of legal process. States are not more willing after the seventh session than they have been to entrust their sovereign rights to third-party settlement. (Coffey-Florida)
W79-09323

BOUNDARY WATERS CANOE AREA WILDERNESS ACT.
Public Law 95-495, secs 1 thru 21, 92 Stat 1649 (1978).

Descriptors: *Public lands, *Public access, *Water quality, Environmental control, Federal government, Wildlife, Public benefit, Legislation, Biological communities, Mineral industry, Recreation.

The purpose of the Boundary Waters Canoe Area Wilderness Act is to provide for such measures respecting the areas designated by the Boundary Waters Canoe Area Wilderness Act (Act)-the Boundary Waters Canoe Area Wilderness and Boundary Waters Canoe Area Mining Protection Area. The Act attempts to achieve the following: (1) provide for the protection and management of the fish and wildlife to enhance public enjoyment and appreciation of the region's unique biotic resources; (2) protect and enhance the natural value and environmental quality of the lakes, streams, shorelines and associated forest areas; (3) maintain high water quality; (4) minimize to the greatest extent possible the environmental impacts of mineral development; (5) prevent further road and commercial development and restore natural conditions to existing temporary roads; and (6) provide for the orderly and equitable transition from motorized recreational uses to nonmotorized uses on those lakes, streams, and portages where such mechanized uses are to be phased out under the Act's provisions. (Coffey-Florida)
W79-09324

THE 95TH CONGRESS: PARKS AND WILDERNESS,
K. Barton.
Environment, Vol. 20, No. 9, p 37-39, Nov. 1978.

Descriptors: *Wildlife conservation, *Parks, *Preservation, Wildlife, Environmental control, Environment, Environmental effects, Political constraints, Water policy, Federal government.

In the closing hours of the 95th Congressional session, the Boundary Water Canoe Area (BWCA) Wilderness bill was passed. BWCA is the largest wilderness east of the Rockies and the most heavily visited in the nation. It is located on the northeastern border of Minnesota. The million-acre BWCA is best known as the country's only lakeland wilderness, where canoeists can explore for days with almost no reminder of the world outside. Certain exceptions to the 1964 Wilderness Act made the BWCA a second-class wilderness, open to extensive motorboat use. For the past 15 years conservationists have been engaged in a bitter fight to protect the area. The BWCA bill passed and signed by the President settled the dispute. The new law embodies a compromise on the motorboat issue reluctantly agreed to by environmentalists. It cuts motor use in the BWCA to about half of the present use, and restricts motorboats primarily to lakes on the wilderness's periphery. Motor size is limited depending on the lake's characteristics, and motor use on some lakes will be phased out. Also, a major stretch of the BWCA on the Canadian border will be open to motor use until 1984. (Coffey-Florida)
W79-09325

OUTER CONTINENTAL SHELF (HOUSE REPORT NO. 95-590).
House Report No. 95-590 accompanying H.R. 1614, Outer Continental Shelf Committee, U.S. House, August 29, 1977.

Descriptors: *Continental shelf, *Oil fields, *Resources development, Federal government, State government, Oil pollution, Oil spills, Oil reservoirs, Oil, Environmental effects, Energy.

H.R. 1614 (Bill) will amend the 1953 Outer Continental Shelf Lands Act to provide a new statutory regime for the management of the oil and natural gas resources of the Outer Continental Shelf. The Bill will expedite the systematic development of the Shelf, while protecting our marine and coastal environment. The Bill's basic purpose is to promote the swift, orderly and efficient exploitation of our almost untapped domestic oil and gas resources in the Shelf. During the 1980's, oil and gas development on the Outer Continental Shelf is likely to be one of the single largest sources of additional domestic energy, at a lower development and impact cost than most alternatives. The Bill's other purposes are to: (1) improve provisions for lease administration; (2) require submission of exploration and development plans; (3) allow new exploration techniques; (4) provide for coordination with governors of effected states; (5) require baseline and monitoring studies; (6) require use of best available and safest technology where economically achievable; (7) reduce frivolous lawsuits by providing expeditious procedures for citizen's suits; (8) establish an offshore oil spill pollution fund; (9) provide grants to impacted states; and (10) establish fishermen's contingency fund. (Coffey-Florida)
W79-09327

CONSTRUCTION AND APPLICATION OF SECTION 23(B) OF FEDERAL POWER ACT, REQUIRING ANY PERSON INTENDING TO CONSTRUCT DAM OR PROJECT ON NON-NAVIGABLE STREAM TO FILE DECLARATION OF SUCH INTENTION,
M. A. DiSabatino.
40 A. L. R. Fed. 981-906 (1978).

Descriptors: *Federal power act, *Dam construction, *Project planning, *Non-navigable water, Water resources, Federal government, Public lands, Water law, Water policy, Navigable water, Federal jurisdiction, Dams.

The federal court cases which have construed the provision of Section 23(b) of the Federal Power Act are collected and analyzed. Section 23(b) requires one intending to construct a dam or other project works on a non-navigable stream, over which Congress has jurisdiction under its authority to regulate commerce, to file a declaration of such intention with the Federal Power Commission (FPC). The FPC will then decide whether the project will affect the interests of interstate or foreign commerce, in which case the project must be licensed by the FPC. Under Section 23(b), Congress vested in the FPC this power of licensing authority. The Federal Power Act supercedes state law, although Section 23 (b) provides that for projects not covered within the terms of the Act (compliance with state law is sufficient). In addition to its affect on state law, Section 23(b) must be reconciled with other Federal legislation concerning the development of water power. (Coffey-Florida)
W79-09328

WATER POLICY: BATTLE OVER BENEFITS,
A. Pelham.
Congressional Quarterly Weekly Report, Vol. 36, No. 9, p 565-74, March 4, 1978.

Descriptors: *Project benefits, *Political aspects, *Project planning, *Federal project policy, Water policy, Dams, Dikes, Channels, Political constraints, Cost-benefit analysis, Federal budget, Financial feasibility.

Though there have been some changes over the past few years, Congress has retained a close relationship with the major construction agencies - the U.S. Army Corps of Engineers, the Interior Department's Bureau of Reclamation, the Soil Conservation Service in the Agriculture Department and the Tennessee Valley Authority - that build the dams, levees, canals, reservoirs and channels. Congress continues to have the advantage in most water disputes with whatever administration is in office. In deciding which of the many proposed projects to authorize and fund, Congress has developed over the years what is referred to as the 'buddy system', or 'congressional courtesy'. Efforts to reform water policy have sought to minimize the influence of individual members on individual projects, by placing greater emphasis on the national benefits from projects funded with federal tax revenues. The Congressional system of water projects development is analyzed as to: (1) questions raised by the system; (2) the authorization process; (3) the appropriation process; and (4) the Grandfather clauses. A cost-benefit analysis approach is presented. The local community's role in the process is considered. A perspective on the prospects for change is given. (Coffey-Florida)
W79-09329

ENFORCEMENT OF SECTION 208 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972 TO CONTROL NONPOINT SOURCE POLLUTION,
W. C. Wicker.
Land Water Law Review, Vol. 14, No. 2, p 419-46, 1979.

Descriptors: *Federal water pollution control act, *Pollution abatement, *Water pollution sources, Federal government, Agricultural runoff, Industrial wastes, Municipal wastes, Environmental control, State government, Local governments.

Point source water pollution is a recognized problem. The nation has taken great strides in efforts to control industrial and municipal water pollution. The battle has barely begun in the effort to control pollution from agriculture or other nonpoint pollution sources (NPS). The major vehicle for the control of water pollution is the 1972 Federal Water Pollution Control Act Amendments. The only provision of the Act that deals directly with the NPS problem is Section 208. Because a statute's effectiveness extends only as far as its enforcement capabilities, the enforcement of Section 208 as related to the implementation of NPS controls are discussed. Three levels of enforcement are discussed: (1) enforcement by the Environmental Protection Agency; (2) enforcement through the citizen's suit; and (3) enforcement at the state and local level. Unless some legislative changes are made such as either more enforcement power or more financial aid for implementation, the control of nonpoint source pollution will not be achieved. (Coffey-Florida)
W79-09330

6F. Nonstructural Alternatives

POTENTIAL NONSTRUCTURAL OR LOW COST WATERWAYS SYSTEM IMPROVEMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
F. M. Anklam.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A044 343, Price codes: A07 in paper copy, A01 in microfiche. Miscellaneous Paper 0-71-1, June 1971. 148 p, 3 fig, 2 tab, 56 ref, 7 append.

Descriptors: *Mississippi River, *Ohio River, *Missouri River, *Inland waterways, *St Lawrence Seaway, *Rivers, *Navigation, *Louisiana, *Missouri, Locks, Dams, Barges, Costs, Economics, Cost analysis, Non-structural alternatives, Planning, Navigable waters, *Welland Canal(Canada), Waterway transportation, Waterway system improvements, Towing industry.

The inland waterways system of the United States, as it exists today, has a number of problems associated with near-capacity traffic conditions. In many places on the Mississippi, Ohio, and Missouri Rivers and their navigable tributaries, there are serious impediments to the free flow of waterborne commerce. This study was conducted to determine

the potential for more efficient utilization of existing inland waterways resources and facilities as a possible alternative to heavy investment in major construction. The study was based on distribution of a questionnaire, meetings and discussions with the Civil Works Task Group for Inland Waterways Systems Analysis, and visits to Corps of Engineers Civil Works offices and river sites by the author. The inland waterways system is an intimate interweaving of three significant subsystems: the physical waterway, the towing industry, and the commodities. These subsystems and their interrelations were discussed in detail. It was determined that there are a number of areas of potential for improvement in the inland waterways system. These areas involve such items as changes in operating procedures of the locks, revisions of the operating rules for towboats approaching and using locks, staffing considerations, additional assistance at heavily trafficked locks, and other such factors. The following two examples illustrate possible improvements. The study of the Welland Canal in the Canadian portion of the St. Lawrence Seaway was a most productive effort. Through improved management of both the lock system and the shipping in the canal, major investments were delayed while significant increases in ship passage were realized. Also, at the industrial canal in New Orleans, Louisiana, and in recent tests at Lock and Dam 26 on the Mississippi River near St. Louis, Missouri, the use of extra towboats to assist long tows through the locks was very productive. In the Lock and Dam 26 tests, an estimated $100,000 in time-saving benefits was realized by the towing industry for a $26,000 cost. It was concluded that there is considerable evidence that significantly more traffic can be passed through our inland waterways system through the medium of nonstructural or low cost modifications in operating rules, lock operations, and facilities. This will enable the Civil Works Directorate to apply capital improvement investment more effectively at the places where it is the only solution while materially increasing our capability to pass increased traffic at other locations for considerable periods of time. (Sims-ISWS)
W79-09131

INTERRELATING LAND AND WATER MANAGEMENT IN FLORIDA,
For primary bibliographic entry see Field 6E.
W79-09176

ALTERNATIVES TO APPROPRIATION LAW,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 6E.
W79-09315

COMPLIANCE WITH FLOODPLAIN/WETLANDS ENVIRONMENTAL REVIEW REQUIREMENTS (FINAL RULEMAKING).
Department of Energy, Washington, DC.
For primary bibliographic entry see Field 6E.
W79-09321

6G. Ecologic Impact Of Water Development

BYZANTINE DRAINAGE LAW: PENNSYLVANIA'S EXPERIENCE,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
For primary bibliographic entry see Field 6E.
W79-09183

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7A. Network Design

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-09169

7B. Data Acquisition

SPECTRAL MEASUREMENT OF WATERSHED COEFFICIENTS IN THE SOUTHERN GREAT PLAINS,
Texas A and M Univ., College Station. Remote Sensing Center.
B. J. Blanchard, and W. Bausch.
Available from the National Technical Information Service, Springfield, VA 22161 as N78-18482, Price codes: A04 in paper copy, A01 in microfiche. Final Report RSC 3273, January 1978. 57 p, 7 fig, 8 tab, 5 ref, 1 append. NASA NAS5-22534.

Descriptors: *Remote sensing, *Rainfall-runoff relationships, *Watersheds(Basins), Satellites(Artificial), Runoff, Moisture content, Soils, Vegetation, Arid lands, Rainfall, Data processing, Analytical techniques, LANDSAT, Multispectral scanner.

A system or technique that could provide a measurement of the interacting characteristics of the surface and near-surface condition would allow improvement in the estimates of runoff. A previous study had been directed toward classification of the runoff potential of watershed surfaces by use of linear combinations of spectral data from the Multi-Spectral Scanner (MSS). Some encouraging results were obtained using data over 20 watersheds in a two-county area located in central Oklahoma. The original objective of this study was to modify and test the concept of using linear equations of MSS data for the prediction of runoff coefficients for use with the commonly used Soil Conservation Service (SCS) watershed runoff equation. It appears that the predominant factor influencing the classification of watershed runoff curve numbers is the difference in soil color and its associated reflectance when dry. In regions where vegetation grows throughout the year, where wet surface conditions prevail or where watersheds are timbered, there is little hope of classifying runoff potential with visible light alone. (Sims-ISWS)
W79-09134

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME I--EXECUTIVE SUMMARY.
IBM Corp., NY.
Available from the National Technical Information Service, Springfield, VA 22161 as N75-25264, Price codes: A02 in paper copy, A01 in microfiche. Final Report, IBM No. 75W-00056, NASA-CR-143858, 1975. 21 p, 4 fig, 1 tab, 10 ref.

Descriptors: *Remote sensing, *River forecasting, *Model studies, Mathematical models, Computer models, Runoff, Storage, Water storage, Rivers, Floods, Streamflow, Watersheds(Basins), Computer programs, Analytical techniques, Hydrographs, Hydrology.

A computer-based simulation model was adapted to a streamflow forecasting application and implemented in an IBM System/360 Model 44 computer, operating in a dedicated mode, with operator interactive control through a Model 2250 keyboard/graphic CRT terminal. The test site whose hydrologic behavior was simulated is a small basin (365 square kilometers) designated 'Town Creek near Geraldine, Alabama'. This watershed had been modeled in previous studies, and determination of several of its parameters through remote sensing had been found feasible. Operation of the model was demonstrated in February 1975, meeting the primary study objective. A description of the NASA-IBM streamflow forecast model, adequate to instruct another user in its operation, appears in Volume II of this report, in satisfaction of the secondary study objective. (Sims-ISWS)
W79-09143

FORESTRY, GEOLOGY AND HYDROLOGICAL INVESTIGATIONS FROM ERTS-1 IMAGERY IN TWO AREAS OF ECUADOR, SOUTH AMERICA,
Junta Nacional de Planification, Quito (Ecuador).
N. V. Moreno.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-26614, Price codes: A02 in paper copy, A01 in microfiche. Final Report, November 1973. 40 p, 6 fig, 1 tab.

Descriptors: *Remote sensing, *Satellites(Artificial), *Aircraft, *South America, Photography, Aerial photography, Forestry, Forests, Geology, Hydrology, Soil moisture, Tropical regions, Foreign research, *Ecuador, *Guayas River Basin(Ecuador), *Oriente River Basin(Ecuador), ERTS.

Despite heavy cloud cover, ERTS-1 imagery of Ecuador has proved to be exceedingly useful for several types of natural resource interpretations. Using cloud-free portions of ERTS imagery in the Oriente and Guayas River basin areas of the country, investigations were conducted in forestry, geology, and hydrology. Based on the work in forestry, it was found that in the Oriente area, well drained forests containing commercially valuable hardwoods can be recognized confidently and delineated quickly on the ERTS imagery. The work in geology in the Oriente area led to the following conclusions: that even in the tropical rainforest ERTS can provide an abundance of inferential information about large-scale geologic structures (e.g., the major fractures that seem to control several of the oil fields); that ERTS imagery is better than normal aerial photography for recognizing linears in this area; and that working iteratively among ERTS images, photo mosaics, and 1:400,000 photography provides a vital link for extracting the maximum amount of information from each type of imagery and for training interpreters, who are accustomed to standard photography, how to use ERTS imagery. From the work in hydrology, it was concluded that monitoring and control of annual inundation of portions of the Guayas River Basin would be greatly aided by repeated ERTS coverage during the period January through May each year. In this connection, the imagery is particularly useful for updating the changes in distributary channels and estimating the numbers and types of civil works necessary to control flooding. (Sims-ISWS)
W79-09147

LABORATORY MEASUREMENTS OF UPWELLED RADIANCE AND REFLECTANCE SPECTRA OF CALVERT, BALL, JORDAN, AND FELDSPAR SOIL SEDIMENTS,
National Aeronautics and Space Administration, Langley Station, VA. Langley Research Center.
C. H. Whitlock, J. W. Usry, W. G. Witte, and E. A. Gurganus.
NASA Technical Paper 1039, December 1977. 33 p, 13 fig, 12 ref.

Descriptors: *Remote sensing, *Sediments, *Laboratory tests, Soils, Soil types, Reflectance, Equipment, Analytical techniques, Spectrometers, Sedimentology, Marine sediments, Spectral radiance, Nonpoint pollution sources.

A limited effort to investigate the potential of remote sensing for monitoring nonpoint source pollution was conducted. Spectral reflectance characteristics for 4 types of soil sediments were measured for mixture concentrations between 4 and 173 ppm. For measurements at a spectral resolution of 32 nm, the spectral reflectances of Calvert, Ball, Jordan, and Feldspar soil sediments were distinctly different over the wavelength range from 400 to 980 nm at each concentration tested. At high concentrations, spectral differences between the various sediments could be detected by measurements with a spectral resolution of 160 nm. At a low concentration (4 ppm), only small differences were observed between the various sediments when measurements were made with 160-nm spectral resolution. Radiance levels generally varied in a nonlinear manner with sediment concentration; linearity occurred in special cases, depending on sediment type, concentration range, and wavelength. (Sims-ISWS)
W79-09150

APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY,
Norges Vassdrags- og Elektrisitets vensen, Oslo.

For primary bibliographic entry see Field 2C.
W79-09152

ACOUSTIC EMISSION AS AN INDICATION OF STABILITY DECREASE IN FRACTURE ZONES OF AVALANCHES,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
For primary bibliographic entry see Field 2C.
W79-09155

ADMINISTRATIVE ALLOCATION AND ECONOMIC EFFICIENCY,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 6E.
W79-09169

DEVELOPMENT OF A COMPUTER BASED FLOOD FORECASTING SYSTEM FOR AUSTRALIA,
Bureau of Meteorology, Melbourne (Australia).
A. J. Hall, and J. F. Elliott.
In: International Symposium on Logistics and Benefits of Using Mathematical Models of Hydrologic and Water Resource Systems. Preprints of Symposium held at Universita di Pisa, Italy, 24-26 October, 1978. Convened by the International Institute for Applied Systems Analysis (Laxenburg, Austria). 23 p, 1 fig, 6 tab, 5 ref.

Descriptors: *Flood forecasting, *Computers, *Computer programs, Hydrologic data, Operations research, Cost-benefit analysis, Regions, Data collection, Real-time, Hydrologic modeling, Meteorology, Automation, Data processing, Australia, Mathematical models.

Operational flood forecasting in Australia is the responsibility of the Bureau of Meteorology. As part of a planned automation and improvement of meteorological forecast services, a network of mini-computer systems is being proposed for installation in each of the main Regional Forecast Centers. This paper endeavors to show the complexities in developing a computer-based flood forecasting service for a large region. Outlined are considerations necessary in properly specifying the hardware requirements and the design of the combination of computer programs and data files to match the computer-based system to the operation requirement. Discussed are details such as the raw data quantities and the treatment of this data. The system will operate over a wide range of catchments and thus function on various levels of instrumentation and hydrologic sophistication. Emphasized is flexibility within the design, especially in regard to the structure of the hydrologic modeling component. The system involves data collection on a large scale, real time hydrologic modeling, and forecast dissemination to the public. A fairly superficial cost-benefit analysis suggests that the introduction of a computer-based flood forecasting system as part of a computer-based national weather service would have considerable economic advantage over an existing manual forecasting service. (See also W79-09285) (Bell-Graf--Cornell)
W79-09286

7C. Evaluation, Processing and Publication

GEOHYDROLOGY OF COMAL, SAN MARCOS, AND HUECO SPRINGS.
Texas Department of Water Resources, Austin.
For primary bibliographic entry see Field 2F.
W79-09139

SUSPENDED-SEDIMENT LOAD OF TEXAS STREAMS, COMPILATION REPORT OCTOBER 1971-SEPTEMBER 1975,
Texas Dept. of Water Resources, Austin.
For primary bibliographic entry see Field 2J.
W79-09140

8. ENGINEERING WORKS

8A. Structures

BEHAVIOR OF SAND-ASPHALT GROINS AT OCEAN CITY, MARYLAND,
Corps of Engineers, Washington, DC. Beach Erosion Board.
For primary bibliographic entry see Field 2L.
W79-09138

8B. Hydraulics

HYDRAULIC BEHAVIOR OF AN UNCONFINED AQUIFER,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
S. N. Webb, and K. K. Watson.
Australian Water Resources Council Technical Paper No. 38, 1979. 65 p, 25 fig, 2 tab, 15 ref, 1 append. Australian Government Publishing Service, Canberra. 75/85.

Descriptors: *Hydraulic properties, *Aquifers, *Aquifer characteristics, Hydraulic models, Testing, Fluid mechanics, Pumping, Aquifer testing, Drawdown, Discharge measurement, Discharge(Water), New South Wales, Australia.

The hydraulic behavior of a typical unconfined aquifer was studied by instrumenting the core of depression formed during a pumping test with a rapid-response pressure measuring system. The Botany Bay and Georges River Basin in New South Wales was the site of the study. Regional geology and environmental factors are discussed. A 0.20 m bore was equipped with a submersible turbines pump; ten piezometers were located deep in the aquifer; additional pressure sensors were installed progressively as more became known about the behavior of the aquifer. Pump test data are summarized for the eight constant discharge pump tests. Careful analysis showed that the aquifer was not homogeneous and isotropic as initially assumed. Drawdown behavior indicated that two layers of fine material influenced the response of the aquifer. The aquifer at the field site was shown to be leaky and consists of three zones: an unconfined upper zone lying above 7.7 m depth, contributing very little to the discharge from the bore; a zone from 7.7 m to 17 m depth contributing to the bore discharge by leaking through an impeding layer at about 17 m depth; and a semi-confined aquifer lying below 17 m depth. Included is an annotated bibliography on water movement in unconfined aquifers. (Schaefer-IPA)
W79-09083

DESIGN FOR HARBOR ENTRANCE IMPROVEMENTS, WELLS HARBOR, MAINE; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. R. Bottin, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A063 272, Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-78-18, November 1978. 84 p, 8 tab, 41 photos, 5 pl, 6 ref.

Descriptors: *Harbors, *Hydraulic models, *Waves(Water), *Wells Harbor, Maine.

A 1:50-scale (undistorted) hydraulic model of Wells Harbor, Maine, which included the entrance to the harbor, the shoreline south and north of the harbor, and sufficient offshore area to permit generation of required test waves, was used to investigate the effects of proposed improvements at the harbor entrance on wave action. Proposed improvement plans consisted of installation of stone spur dikes in the jettied entrance and a breakwater attached to existing north jetty. A 20-ft-long wave generator, a model circulation system, and an automated data acquisition and control system (ADACS) were utilized. Results: During moderate to large wave attack, existing harbor entrance experiences hazardous navigation conditions due to breaking waves and interaction of waves with tidal currents. Originally proposed spur-dike configuration (plan 1) will slightly increase wave heights in outer entrance (gage 1), will have little effect on wave heights between outer entrance and the bend in the jetties, and will reduce wave heights through remainder of jettied entrance. Changing spur-dike cross sections at entrance (plan 2) will not reduce wave heights there. Installing a breakwater (plan 3) will substantially improve wave conditions in jettied entrance over those for existing conditions or any spur-dike plan tested. (WES)
W79-09092

NAVIGATION CONDITIONS IN ALEXANDRIA REACH, RED RIVER NAVIGATION PROJECT, LOUISIANA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
L. J. Shows, and J. J. Franco.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A064 397, Price codes: A06 in paper copy, A01 in microfiche. Technical Report H-78-24, December 1978. 97 p, 9 tab, 17 photos, 37 pl.

Descriptors: *Navigation, *Hydraulic models, *Alexandria Reach, *Red River Waterway(LA), *Fixed-bed models.

Alexandria Reach is a section of the Red River approximately 87.3 miles upstream of the junction of the Red and Mississippi Rivers. There are five bridges in the reach within a distance of less than 2 miles. A fixed-bed model reproducing about 3.5 miles of the river in the vicinity of Alexandria, Louisiana, to an undistorted scale of 1:100 was used to determine navigation conditions through the reach and to develop modifications to eliminate any adverse conditions. The model investigation was concerned principally with navigation conditions approaching and through the bridges. Results indicate: With existing conditions, navigation through the reach will tend to be hazardous, particularly for downbound tows because of the arrangement and limited width of the navigation spans, the channel and current alignment approaching the bridges, and high-velocity currents. Navigation conditions through the reach with the existing bridges can be improved by modifying the revetment along the left bank in the cutoff and just downstream of the cutoff, excavating the right bank between the two upper bridges, excavating and adding a dike along the left bank upstream of the U. S. Highway 165 Bridge, and adding submerged dikes along the right bank. (WES)
W79-09095

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

CONTROL OF TOXIC EFFLUENTS AND MANAGEMENT OF TOXIC BOTTOM SEDIMENTS,
Water Quality Bureau (Japan). Water Quality Management Div.
T. Hayashi.
In: Management of Bottom Sediments Containing Toxic Substances: Proceedings of the Third U.S.-Japan Experts' Meeting--November 1977, Easton, Maryland. Report No. EPA-600/3-78-084, p 1-9, 1978. 4 tab.

Descriptors: *Water quality control, *Water quality standards, *Mercury, *Polychlorinated biphenyls, *Bioaccumulation, *Japan, Poisons, Heavy metals, Path of pollutants, Water chemistry, Bottom sediments, Chemical wastes, Industrial wastes, Waste disposal, Chemical analysis.

In recent years, the decline in Japanese water quality has ceased and there has been a trend toward slow recovery. This is due to the rigorous control of effluents throughout the country in recent years. This paper explains the water pollution control measures designed to regulate the discharge of toxic substances and treat bottom

sediments containing toxic substances. The control of mercury and PCB contamination is emphasized. (See also W79-09113) (Deal-EIS)
W79-09114

9D. Grants, Contracts, and Research Act Allotments

CONTROL OF TOXIC EFFLUENTS AND MANAGEMENT OF TOXIC BOTTOM SEDIMENTS,
Water Quality Bureau (Japan). Water Quality Management Div.
For primary bibliographic entry see Field 9C.
W79-09114

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GLACIOLOGICAL DATA, THIS ISSUE: GLACIOLOGICAL FIELD STATIONS, PART I,
World Data Center A for Glaciology, Boulder, CO.
For primary bibliographic entry see Field 2C.
W79-09132

GLACIOLOGICAL DATA, THIS ISSUE: GLACIOLOGICAL FIELD STATIONS, PART 2,
World Data Center A for Glaciology, Boulder, CO.
For primary bibliographic entry see Field 2C.
W79-09133

WORLD DATA CENTER A FOR GLACIOLOGY (SNOW AND ICE), NEW ACCESSIONS LIST NO. 1.
Colorado Univ., Nederland. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
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World Data Center A for Glaciology (Snow and Ice), New Accessions List No. 1.
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Chesapeake Bay Future Conditions Report, Volume VI, Appendix 7, Water Quality.
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CORPS OF ENGINEERS, WASHINGTON, DC. BEACH EROSION BOARD.
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Logistics of Large-Scale Water Resources Modeling for Irrigation Planning,
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A Study of Application of Remote Sensing to River Forecasting, Volume I--Executive Summary.
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ILLINOIS INST. OF NATURAL RESOURCES, SPRINGFIELD.
Problem Assessment Report: Soil Erosion Subcommittee--Illinois Agricultural Task Force on Non-Point Sources of Pollution.
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Nonpoint Source Pollution from Agriculture: Some Sociological Considerations for Implementing Policy,
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Development of a '208 Plan' for Agricultural Nonpoint Pollution Sources in Illinois,
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Economic Impacts of Policies to Control Erosion and Sedimentation in Illinois and Other Corn-Belt States,
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Pathogenic Species of Thermophilic and Thermotolerant Fungi in Reactor Effluents of the Savannah River Plant,
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Egg Shell Characteristics of Gannets Sula Bassana, Shags Phalacrocorax Aristotelis and Great Black-Backed Gulls Larus Marinus Exposed to DDE and Other Environmental Pollutants,
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Evaluation of Controls for Agricultural Nonpoint Source Pollution,
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Estimation of Agricultural Nonpoint Loads to the Wakarusa River Basin Using the 'Nonpoint Calculator',
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NEW YORK STATE DEPT. OF ENVIRONMENTAL CONSERVATION, ROME.
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Model for the Selection of Appropriate Technology for a Water Resources System,
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Effects of Fluctuating Flow Rates and Water Levels on Chironomids: Direct and Indirect Alterations of Habitat Stability,
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PACIFIC RESEARCH INST. FOR FISHERIES AND OCEANOGRAPHY, MAGADAN (USSR). MAGADAN DEPT.
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A Moving Cell Model of the Dissolved Oxygen and Phytoplankton Dynamics in Rivers,
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PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRONOMY.
Sediment and Nutrient Contributions to the Maumee River from an Agricultural Watershed,
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Secondary Productivity of the North Pine Dam,
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Estimating Impacts of Silvicultural Management Practices on Forest Ecosystems,
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An Approach to Water Resources Evaluation of Nonpoint Sources from Silvicultural Activities--A Procedural Handbook,
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SKELLY AND LOY, HARRISBURG, PA.
North Branch Potomac River Basin Mine Drainage Study--Phase I. Baseline Survey.
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SMITHSONIAN INSTITUTION, EDGEWATER, MD. CHESAPEAKE BAY CENTER FOR ENVIRONMENTAL STUDIES.
Non-Point Source Studies on Chesapeake Bay, 4: Weekly Surface Hydrology of Seven Sub-Basins Within the Rhode River Watershed, Calendar Years 1974-1975-1976, CRC Publication No. 57,
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